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POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

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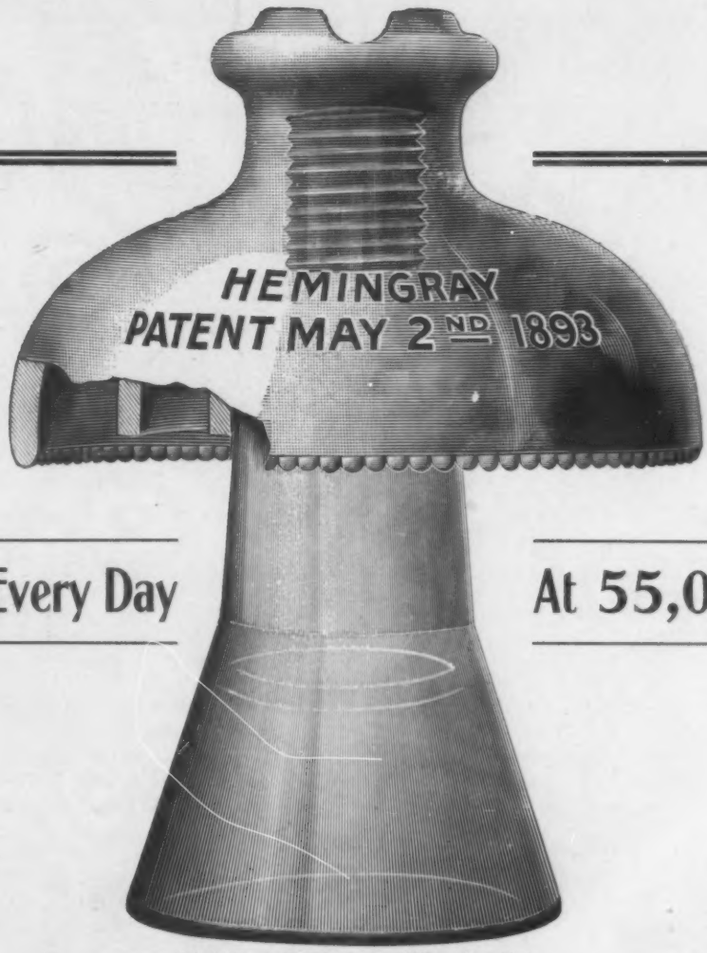

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXIX SAN FRANCISCO, JULY 27, 1912 NUMBER 4

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SEATTLE MUNICIPAL LIGHT AND POWER PLANT

BY J. D. ROSS.

Cedar Lake, the source of power for the Seattle municipal light and power plant, familiarly known as the City Light Plant, is situated in the Cascade Mountains, southeast of Seattle and at a distance of about 43 miles. The normal lake level lies at an elevation of 1530 ft. The lake is approximately 1.91 square miles in area and drains a watershed of 79 square miles. The mountains hold a considerable amount of their snow during the early summer and fall, and so give a more continuous flow of water throughout the year. The rainfall is enormous over this district, amounting to an average of 111.02 in. per annum at the lake level, with a greater precipitation at high elevations, due to the greater chilling of the clouds in passing over the mountains.

The lake discharges at its northerly end into Cedar River, a swift mountain stream which, after tumbling through rapids and cascades, between rocky walls for 3½ miles, reaches a valley over 600 ft. below the lake level. At this point the generating station of the City Light Plant is situated.

In order to supply power for the generating station, a rock filled timber dam 250 ft. across was constructed in the river about three-quarters of a mile from Cedar Lake, raising the original lake level 18 ft. This dam impounds sufficient water to operate the plant with its present needs for 40 days in dry weather, without considering the natural inflow during this time.

Cedar Lake and Upper and Lower Falls

From the control gates at the dam two pipes, one 48 in. and one 68 in. are laid to carry the water to the plant below. These pipes are built of wood staves banded with steel for a distance of approximately 15,400 ft.; the remainder of the distance, about 1000 ft. is constructed of riveted steel pipe. Both pipes are almost entirely underground covered with 18 in. of earth. The combined maximum capacity of these two pipes is 14,000 h.p.

The power house contains generators of a total maximum capacity of 18,000 h.p., all of which can be utilized by providing an additional pipe and some additional storage. To complete the plant and develop its ultimate capacity it is necessary to impound the entire run-off of the watershed. To this end a concrete dam is being con-

SHOWING CROSSING OF PIPELINES No. 1 & 2

CEDAR LAKE DAM WITH 9 FEET OF WATER OVER CREST

6 Ft. PIPE LINE FROM CEDAR LAKE TO SEATTLE CITY LIGHT POWER PLANT

MASONRY DAM SITE

THE CITY OF SEATTLE

TOTAL HEIGHT OF PROPOSED DAM 202 Ft.
LENGTH ALONG THE TOP OF DAM 640 Ft.
DEPTH OF FOUNDATION BELOW RIVER BED 40 Ft.
EL. OF TOP OF DAM 1800 Ft. ABOVE SEA LEVEL
ORIGINAL ELEVATION OF LAKE 1530 Ft. AB. SEA LEV.
PRESENT " " " 1550 Ft. " " "
PROPOSED " " " 1600 Ft. " " "
AREA OF WATER SHED ABOVE THIS POINT 64 SQ. MI.

SKETCH OF NEW CONCRETE DAM

SITE OF NEW CONCRETE DAM

LOOKING ACROSS SITE OF NEW DAM

structed at a point in Cedar River 2¼ miles below the lake. This dam will be 720 ft. long and 215 ft. high and will raise the original lake level 75 ft., or an additional 58 ft. above the crest of the present dam, and will increase the size of Cedar Lake to 5.23 square miles. The total power available after this work is done will be 14,950 kw. continuous every hour of the year. The average load for the year in the city plant will probably be about 40 per cent of the maximum load, and consequently the machinery which can be operated from the new reservoir will be not less than 37,400 kw., measured on the switchboard at Cedar Falls Station. This is a very conservative estimate.

Cedar River is also the source of the city water supply and the new dam will greatly increase the capacity of the water system as well as of the lighting system. The water is remarkably pure and clear, and in order to maintain the best sanitary conditions an enormous amount of timber is being cut and cleared off from the area to be overflowed by the lake when the new dam is completed.

The city power plant is situated near the town of Cedar Falls, on the Chicago, Milwaukee & Puget Sound Railway.

The generators at the power house, four in number, are direct connected to water wheels, two of which are turbines and two impulse wheels, the whole being set on solid bed rock. The wheels discharge into Cedar River. The city has provided six modern houses for its employees at the power station. Sanitation is carefully observed and all sewage is carried away from Cedar River to the Snoqualmie watershed.

Current is generated at the power house at 2300 volts, and stepped up to 60,000 volts for transmission to Seattle. Two entirely separate lines are used for added security to the service. These lines are each 38.7 miles in length and come over private right of way for the entire distance. All timber that could fall and touch the lines has been cut. A line patrolman is stationed at Landsberg and one at Renton. These lines enter the Seattle substation at Seventh avenue and Yesler Way, where the voltage is stepped down to 7500 and 2500 for city distribution.

The distributing system includes 17,600 poles and 3661 miles of wire operating in connection with 1159 transformers, supplying approximately 20,000 customers, besides a street system consisting of 692 arc lamps, 199, 300 and 350-c.p. and 5315 40-c.p. series tungsten lamps lighting 601 miles of street, and 1631 ornamental iron cluster light poles lighting 25 miles of street. Of these poles 1116 carry five globes, 378 carry three globes, and 137 carry one globe each.

Dam and Head Gates.

The dam is 250 ft. wide and is constructed of timber cribs filled with rock. The foundations and wings are dug deep into a sand formation, there being no rock in the vicinity. The dam was completed in 1904, the intention being to build a large concrete dam one and one-half miles below this point, where rock foundations could be got, as soon as the size and success of the plant would warrant the ultimate development. The new dam is now in process of construction. The south wing of the timber dam carries the head gates for the two pipe lines which supply the plant. The spillway is placed in the centre of the dam. This dam has done remarkably good service, taking care of floods nine feet over the spillway without difficulty or damage other than the breaking during 1911 of part of a 4.8 ft. superstructure on the spillway, which was not a part of the dam proper.

Pipe Lines and Penstocks.

From the dam two wood stave pipe lines lead out to supply the water wheels at the power house. One of these pipes, built in 1904, is 49 inches inside diameter built of 30 staves 1 9/16 in. thick from 2 in. x 6 in. stock. The other pipe, built in 1908, is 67¾ in. inside diameter, built of 30 staves 2¼ in. thick from 2½ in. x 8 in. stock, and banded for a factor of safety of four. These pipes are buried under 18 in. of earth and rock on account of the heavy timber through which they pass. The highest head under which the wood stave pipe operates is 310 ft. The sharpest curve used in wood stave is 18 degrees. Sharper angles than it was possible to turn with this radius of curvature were made by using riveted steel elbows of 15 ft. radius. Five of these elbows from 45 degrees to 90 degrees are used in the larger pipe. At a point 951 ft. from the power house and under a head of 310 ft., the larger pipe branches through a Y and two 48 in. valves into two 48-in. riveted steel pipes. The total length of the larger wood stave pipe is 15,865 ft. making the entire pipe line 16,816 ft. in length. At a pocket 1008 ft. from the power house the smaller wood pipe also connects to a 48-in. riveted steel pipe. The total length of the smaller wood pipe is 15,407 ft., making the total length of this pipe line 16,415 ft. A factor of safety of five is used on the steel pipe.

At the power house an interconnecting system with valves is arranged such that any one of the three pipes may be used on any of the four machines and the pipes are normally left with these valves open to equalize water ram and better the regulation.

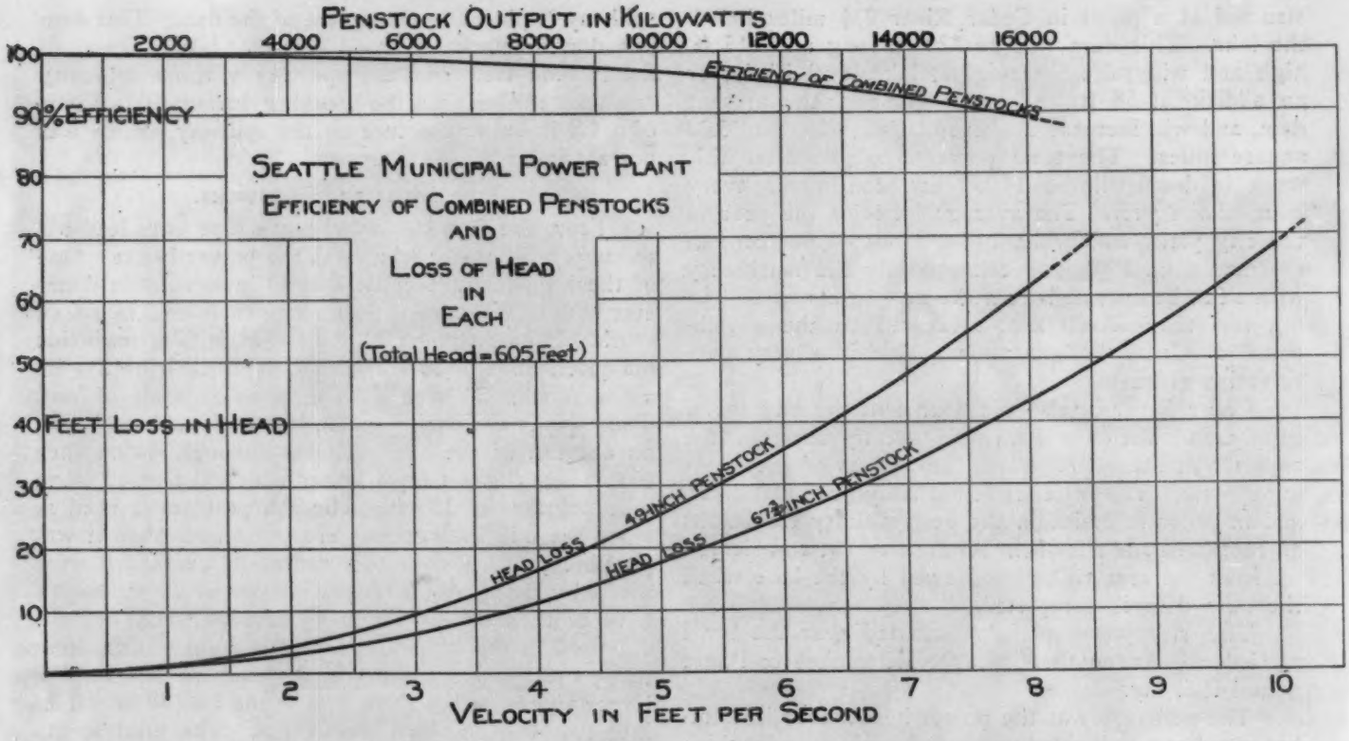
A 30-in. steel standpipe is placed on the hill approximately 3600 ft. from the power house on each pipe to further decrease the effect from ram and danger of collapse. These pipes are 65 ft. and 70 ft. in height respectively on the smaller and larger pipe. Smaller standpipes and air valves are placed at a number of points along both lines.

The maximum static head on these pipe lines with reservoir full including 3 ft. of flash boards is 614 ft. The all-day efficiency of the two pipes working in multiple for the year 1911 computed from recording gauges was 97.9 per cent. A careful test was made of the 67¾-in. pipe with the following results:

Velocity in Feet Per Second	Loss in Entry and Screens	Elbow No. 1 92 Degrees.	Elbow No. 2 55 Degrees	Elbow No. 3 60 Degrees	Elbow No. 4 65 Degrees	Elbow No. 5 45 Degrees	Total Loss in Pipe	Friction Loss After Deducting Entry and Elbows	Loss in 67¾ Inch Stave Pipe Per 1000	Value of C in Kutters Formula	Value of N in Kutters Formula
2½	.06	.03	.03	.03	.03	.01	4.1	3.91	.246	134.06	.01190
5	.25	.09	.08	.08	.08	.05	15.4	14.77	.931	137.96	.01175
7½	.54	.25	.18	.19	.20	.14	33.9	32.40	2.0425	139.71	.01165
10	1.14	.46	.34	.36	.37	.27	61.9	58.96	3.775	137.01	.011865

This pipe has been in operation since November 20th, 1908.

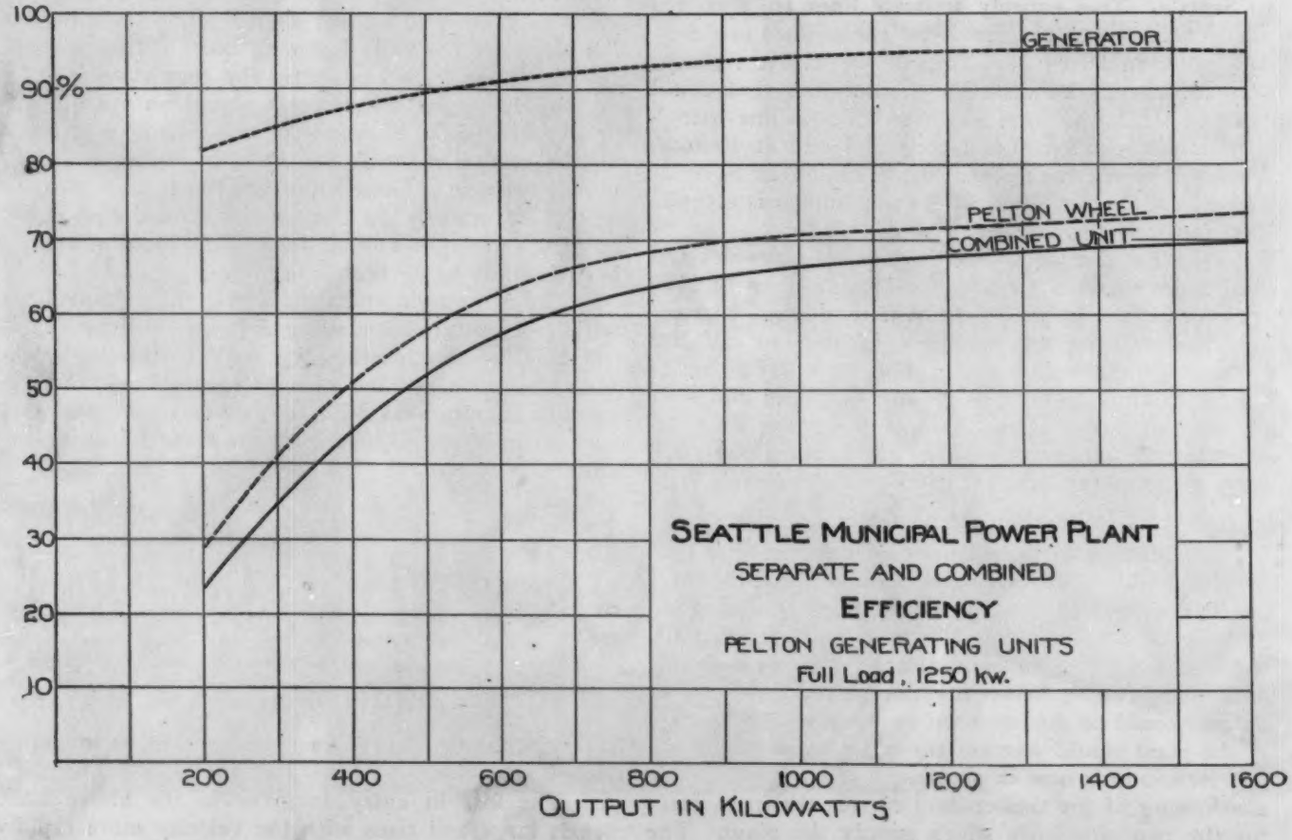
The loss in entry as given in the above table seems large and rises with the velocity more rapidly



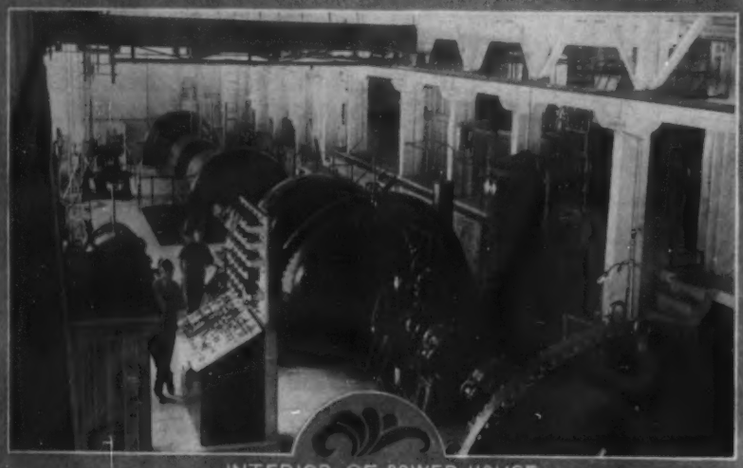
than it should. This is apparently due to the resistance of the screens which are of wood bars. These were being changed before the test was made as it was noticed at times of heavy load that there was a difference of level on the two sides of the screens. The entry of the pipe is bell-mouthed. The line was designed for a slope of 4 ft. per thousand ft. to give a velocity of 10 ft. per second.

Generating Station.

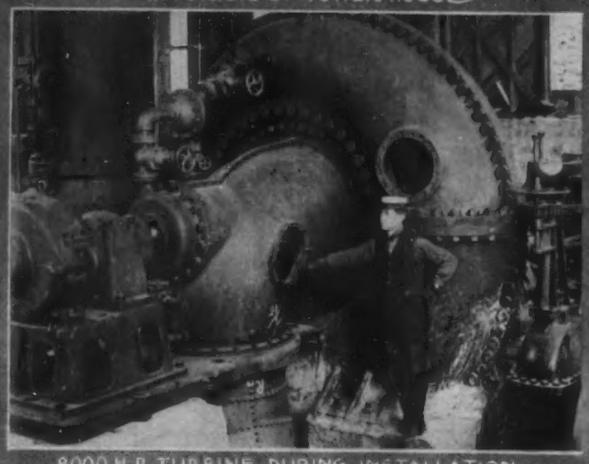
There are four units in the power house, two of which consist of 8000 h.p. Platt Iron Works Francis turbines direct connected to Westinghouse 60 cycle 2300 volt, 3-phase generators rated at 4000 kw. at 35 degrees C. rise with a four hour overload of 5000 kw. capacity for four hours at 40 degrees C. rise. These units operate at 600 r.p.m. The other two units



EXTERIOR OF POWER HOUSE . . . CEDAR FALLS



INTERIOR OF POWER HOUSE



8000 H.P. TURBINE DURING INSTALLATION

are driven by 2400 h.p. Pelton impulse wheels direct connected to Bullock 60 cycle 2300 volt, 3-phase generators rated at 1200 kw. at 35 degrees C. rise, with a four hour overload capacity of 1500 kw. at 40 degrees C. rise. These units operate at 400 r.p.m. The wheels are each equipped with two runners, each of which is supplied from a needle and a deflecting nozzle. The combined capacity of the present installation is therefore 13,000 kw. on a 40 degree rating. The Bullock machines, however, exceed their rating and have been operated continuously without excessive heating at 1750 kw., making the combined capacity 13,500 kw. Three water wheel exciter units are installed, two of which have a capacity of 75 kw. each, and the third 150 kw.

A careful test of turbines, impulse wheels and generators has been made to compute the losses in each. In making these tests the generator losses at all loads were first obtained, after which the wheel efficiency was obtained by measuring the water over a weir built in the tail race, the results being very carefully checked by a current meter. In all over 200 readings were taken to get the most accurate results. The output was measured at the terminals of the generator.

As the efficiency of each unit varies with the load and it is obviously impossible to have all generators that are in use at any time carry their full load, the all day efficiency of the generating station will depend on the number of units in use and the load which each carries as well as the power factor of the load, and in the case of our plant, where two types of wheels are used, it will also depend on the proportion of the load that the operator gives to each type of machine. In general, the greatest all day efficiency can be had by keeping the machines as nearly as possible at the load of maximum efficiency, and by shutting down the machines without load as far as can conveniently be done.

In this plant we have to deal with a three and one-half mile pipe line with the only place suitable for a standpipe 3600 ft. from the wheels, and conditions are made more difficult by the fact that they are operating under 600-foot head and 74 per cent of the plant capacity is turbine driven. The objection to turbines for regulation is very largely overcome by the use of relief valves, which work satisfactorily.

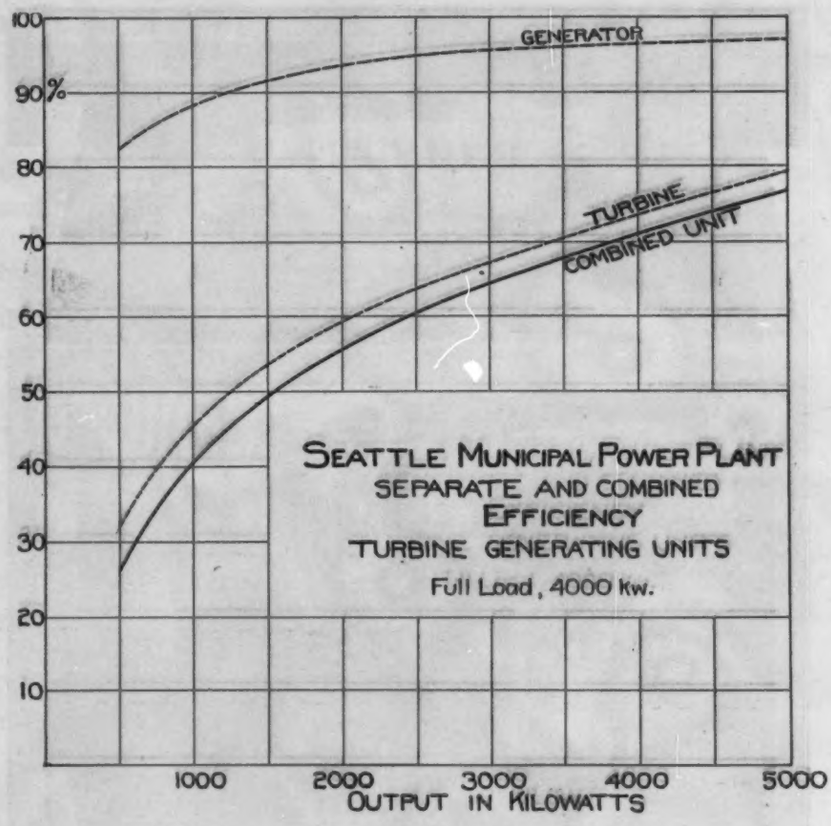
The all-day efficiency was computed from the half-hour readings of each unit as shown by the daily reports of the station, and the results checked against the watt hour meters. This study brought out the important fact that in determining the amount of power in a reservoir the efficiency ordinarily assumed for the power units is much too high and misleading. While the combined maximum efficiency of generator and wheel was found in the case of the 5000 kw. units to be 76.7 per cent and in the case of the 1500 kw. units to be 69.9 per cent, the all-day efficiency of the plant for 1911 was found to be 56.7 per cent. This does not include current for excitation and station lighting. By including this as a loss, the all-day efficiency of the plant drops to 55.7 per cent.

The all-day efficiency of the impulse wheels was 65.8 and 61.1, and the turbine units 53.1 and 59.8. The reason for the differences in the same type of unit is found in the fact that the operators favor No. 1 and

No. 4 machines, from habit rather than intention. The impulse wheels being small are operated under full load for a great part of the day and their all-day efficiency is greater than that of the turbines, notwithstanding the higher efficiency of the turbine sets at full load. It will be readily seen from these facts that the efficiency of a plant depends very largely on the way it is handled by the operator and during low water periods it is possible to prepare a schedule showing which machines should be used for each load which the plant carries. This schedule will be modified by the conditions of the plant, changes in load, and regulation.

The excitation for the entire plant for 1911 has been an average of 45.5 kw. and 1.39 per cent of the output of the machines in kw.-hrs.

The governing of the wheels is done by type N Lombard governors and synchronous relief valves in the case of the turbines and by Lombard-Replogle mechanical governors in the case of the impulse wheels. The latter governors act on the deflecting nozzles and on a deflecting hood on the needle nozzles.



Station Control Board and Wiring.

The control board resembles a bench board and has all water wheels, governors, generators, exciters, busses, transformers and switches represented in the relation they bear to each other. The different machinery is represented in gun metal finish; the d.c. exciter system and bus in nickel; the 2300 volt system and busses in brass, and the 60,000 volt system, busses and lines in copper. Signal lights and bulls'eye lenses are used for all switches.

The control for the station for switches and motors is 125 volt from a separate 25 kw. generator direct connected to an overhung Pelton wheel and having a flywheel on the other end of the shaft. Arrangement is made for the control of all rheostats, switches, valves and governors by motors or solenoids and as the board is only 72 inches by 36 inches, the entire station is well under the control of one operator.

The measuring and synchronizing instruments are grouped directly in front of the control boards, being placed on vertical panels of blue Alaska marble. All instruments, both direct current and alternating current, are of the horizontal edgewise type. The oil switches and busses are placed in concrete cells and all 2300 volt connections and busses are heavily wrapped with empire cloth and varnished. Beside the 60,000 volt selector switches, there are in a separate stone building two main 60,000 volt electrically operated oil switches capable of opening under any conditions. Open air switches in multiple with the oil switches are arranged for closing during repair or accident to the oil switches without interrupting the line.

The Department makes in its own shops all its 60,000 volt switches, both air and oil break, and all switchboards, measuring transformers, both potential and series, overload relays, and special apparatus.

Step-Up Transformers.

The station is equipped with nine Fort Wayne transformers arranged in concrete cells in three banks, one bank to each cell. Each bank has a normal capacity of 4500 kw. at 35 deg. C. temperature rise. These transformers step the voltage from 2300 to 60,000 volts three phase star connected. All high tension wiring is done on iron pipe framework using metal pins. The neutral of the star connection is grounded.

These transformers were carefully tested and the all-day efficiencies computed. The maximum efficiency at full load showed 98.6 per cent and the all-day efficiency during 1911 showed 96.1. All these tranformers were in circuit continually to keep them in good condition and their core losses were continuous. They are insulated with solid ⅛-inch micanite partitions and molded mica channels on coils next to the iron core. The result of this extra insulation is that the operation of these transformers since their installation has been under all conditions all that could be desired.

[The foregoing description is taken from the Annual Report of the Lighting Department and will be concluded in succeeding issues.]

According to the report of W. H. Storms, State Mineralogist, hydro-carbons, including petroleum, natural gas, bituminous rock, exclusive of asphalt and all other refined products, to the value of $41,161,226 were produced in California during 1911. The output is divided as follows:

Petroleum; sold in 1911, or in storage December 31 ..... $37,920,820
Petroleum; used as fuel in the field..... 2,631,268

PHOTOGRAPHY IN ENGINEERING

BY M. R. LOTT.

Bromide Enlargements.

For exhibition purposes it is often desirable to show pictures in a larger size than those made directly from the negative. Pleasing results are best obtained by the use of bromide enlargements, in which detail is preserved to a remarkable degree. Truly beautiful pictures result from enlarging from landscape negatives, especially if the prints made are redeveloped and given a sepia tone. Bromide paper is best adapted for making enlargement, but as it is very sensitive to the light extreme caution must be observed while handling it.

In the arrangement of the printing room given in Figs. 1 and 2 provision is made for making enlargements by daylight. Should it happen that the north window does not have an unobstructed view of the horizon, light may be reflected from the sky by placing a white surface at an angle of 45 deg. with the horizontal outside the window.

If the negative to be enlarged is on a glass plate, it may be slipped in the plate-holder attached to the window opening as it is, but if the negative is on a film it may be held flat by placing it between two clear glass plates, the combination being slipped into the plate-holder. The camera back is opened up and the camera attached to the device at the window opening. Support is furnished by a small stand placed on the work table. The camera shutter should be fully opened to permit sufficient light to pass through for easy focusing of the image on the screen. The size of the enlargment depends upon the focus of the lens and the distance of the screen from the negative. The farther away the screen is placed, the larger will be the size of the picture. When the size of enlargement is obtained by shifting the screen back and forth, the image is brought sharply into focus by racking the lens. Focus should be first secured on white paper placed on the screen, then the diaphragm shut down to about stop 16 (U. S. system) in order that the image may be sharply defined. The shutter is then closed and the bromide paper attached to the screen by thumb tacks. In order to best judge the time of exposure to be given it is well to use a narrow test strip of bromide paper placed diagonally across the screen giving different parts of the strip different lengths of exposure.

The processes of development, fixing and washing are practically the same as for ordinary velox prints, though slightly different solutions are used. The formulas for this will be found in the next issue of the Journal.

Mixing of Solutions.

As a rule it will be found cheaper and more convenient to mix the solutions used, for one is then able to vary the different chemicals to suit his own purposes.

In order to mix chemicals there must be a pair of balances for weighing, a vessel (enameled ware) for mixing and means for heating the water used. Distilled water costs very little and its use elminates many of the troubles which might occur in development.

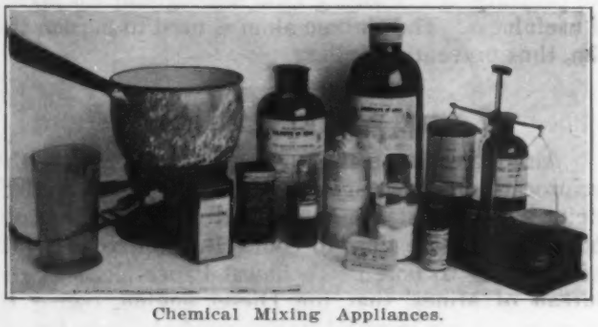
The apothecaries system of weights and measures is used except in the preparation of solutions according to the directions given by the Eastman Kodak Company. These latter are mixed according to avoirdupois weights.

Apothecaries' Weight—		Avoirdupois Weight—	
1 scruple =	20 grains	1 drachm =	27.34 grains
1 drachm =	60 grains	1 ounce =	437.5 grains
1 ounce =	480 grains	1 pound =	7000.00 grains
1 pound =	5760 grains		

The following relation exists between the powdered and crystalline states:

2 oz. Sulphite of Soda (dessicated) = 4 oz. crystal
2 oz. Carbonate of Soda (dessicated) = 5 oz. crystal

Most of the chemicals used are extremely poisonous, consequently they should be so labeled and treated accordingly.



Chemical Mixing Appliances.

Formulas.

The following formulas have been selected from those given by different photographic firms and are those which have been found by trial to yield the best results.

Cramers X-Ray Developer.

This developer is an excellent one to use for negatives taken of drawings, for it produces very clear high lights. With this solution, plates should be developed till practically none of the image can be seen when held before the ruby light for the purpose of looking through. Development for a properly exposed plate lasts about 15 minutes.

The developer may be mixed in the quantity given by the formulas and kept in bottles for use. The chemicals must be dissolved in the order named.

APOTHECARIES' WEIGHTS.

Solution A.

Water	32	ounces
Hydrochinon	1½	ounces
Sodium Sulphite (dessicated)	1	ounce
Sulphuric Acid	60	minims

Solution B.

Water	32	ounces
Sodium Carbonate (dessicated)	1	ounce
Potassium Carbonate (dessicated)	3	ounces
Potassium Bromide	120	grains
Sodium Sulphite (dessicated)	3	ounces

To use take equal parts of A and B.

Eastmans Developer for Plates and Films.

This is an excellent developer to use with plates and films when it is desired to bring out the detail.

AVOIRDUPOIS WEIGHTS.

Pyrogallic Acid	5 grains
Sulphite of Soda (dessicated)	35 grains
Water	8 ounces
Eastman's M. Q. developer, stock solution	½ ounce

Eastmans Pyro Developer.

This developer gives good results where detail is desired, but does not keep especially well. It is used for plates or films.

AVOIRDUPOIS WEIGHTS.

Solution A.

Pyrogallic Acid	484 grains
Oxalic Acid	12 grains
Water	11 ounces

Solution B.

Sulphite of Soda (dessicated)	3 oz. + 12 grains
Carbonate of Soda (dessicated)	2 oz. + 8 grains
Water	77 oz.

To use take 1 part A
7 part B
12 part Water

Dissolve in the order named:

Water	11 oz.
Hypo	1 oz.
Sulphuric Acid	1/6 oz.
Chrome Alum	2/3 oz.

Chrome Alum Fixing Solution.

This solution is an emerald green in color and has the property of remaining clear throughout its period of usefulness. The chrome alum is used to harden the film, thus preventing frilling.

THE DIESEL ENGINE.

Although the steam turbine has superseded the reciprocating steam engine for the generation of electricity in central-station work, and will probably hold the field for some time to come, R. H. Fernald finds it interesting to note in Technical Paper No. 9 of the Bureau of Mines, that the Diesel engine, owing to its great success in small station work, is looked upon seriously as a proximate possible rival to the steam turbine. In a paper recently presented before the Municipal Electrical Association at Brighton, England, the relative cost of a 10,000-kilowatt installation for steam turbines, gas producers and engines, and Diesel engines, was discussed at length. The author proposed the use of seven sets each of 1450-kilowatt capacity. His figures of operating expense, etc., are decidedly in favor of the Diesel-engine installation.

Attention was also called to the very economical use of these engines as a substitute for substation converting machinery. Such stations are already appearing in London.

In this connection the increase in the size of the Diesel-engine is worthy of note. Engines of a few hundred horsepower have become common in Europe. In Swiss electric stations Diesel-engine units of 2000 h.p. are now in use, and one writer states that the development of the large-sized Diesel engine has been so successful that it will not be long before 1000 h.p. developed in one cylinder will be deemed nothing extraordinary. One company of world-wide reputation is at present considering more than 2000 h.p. in the single cylinder of Diesel engines. It is stated that engines of this type with four cylinders, developing 1000 h.p. each, can be made as light as the corresponding triple-expansion steam engine.

The weight of such engines compares favorably with that of the corresponding turbines and boilers. It is understood that a 1000-h.p. installation of this type weighed only 187 lb. per h.p. as compared with 180 lb. for a steam turbine and boiler installation.

The crude-oil engine is now definitely under consideration for all types of marine craft. For small vessels the advantage lies in the safety afforded by the use of crude oil as compared with lighter oils. The crude-oil engine is being used by many of the principal navies of the world for submarine boats, and designs are already under way for comparatively large engines for torpedo boats and other similar craft.

A few months ago the Vulcanus, a vessel of 1900 tons displacement, 196 feet long, equipped with six-cylinder four-cycle single-acting reversible Diesel engines, was put in regular service between Holland and Borneo. This engine is about 500-brake h.p. capacity at 180 revolutions per minute. The fuel is a crude oil from Borneo, and the quoted guaranties are 0.42 lb. per brake h.p. hour at full speed; 0.44 lb. at three-quarters speed; and 0.5 lb. at half speed. In a recent trip the Vulcanus covered 3312 miles in 19 days and 3 hours. The average speeds varied from 6.86 to 7.80 knots. It is reported that the average consumption for this ship amounts to one ton of fuel oil per 100 knots.

The technical journals of recent date record many such installations. Among these Russia is credited with at least four freight vessels of 1000 h.p. and two 14-knot gunboats of the same horsepower rating. In December, 1911, two vessels, nearly 400 ft. long and of 7000 tons capacity, each fitted with Diesel engines of 2500 h.p. rating and with two auxiliary Diesel engines aggregating 500 h.p., were being tried out in European waters.

The attention of marine engineers is especially directed to the most recent development in the oil-engine field—the Junkers oil engine. These engines for the freight vessel of the Hamburg-American Line are of the twin-tandem type of 1600 total shaft h.p each. The engines operate on the two-cycle principle, and through the introduction of two pistons into each cylinder double action is obtained.

An interesting comparison will shortly be placed before the public by the British Admiralty, which proposes to try out side by side in a twin-screw cruiser a steam engine and a Diesel engine of 6000 h.p. rating.

A destroyer recently ordered by the British Admiralty, according to current reports, will have on each shaft a steam turbine and a Diesel engine. The plan is to operate the turbines when high speeds are required, but, under cruising conditions, when the speeds are low, owing to the poor economy of the steam turbines, the Diesel engines will be used. The combined economy from this arrangement will be exexceedingly interesting.

One of the interesting features of engine development is the fact that there seems to be a marked tendency toward the two-stroke cycle for marine work.

With the introduction of internal-combustion engines the discomforts of the stokehole will be greatly reduced, the labor required will be less than under present marine conditions, and the character of the labor will be much improved.

GRAPHIC REPRESENTATION OF ELECTRIC RATES.

BY H. E. EISENMENGER.

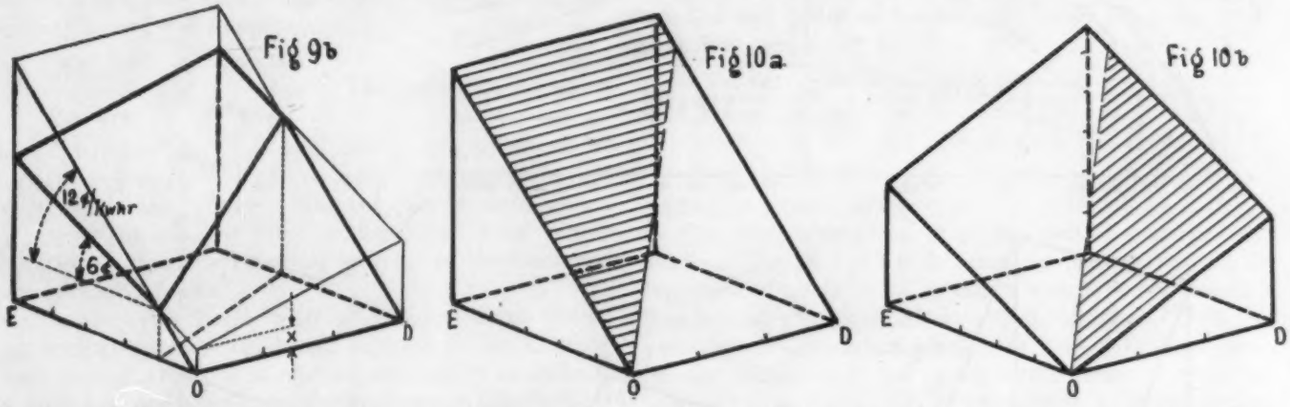
(Concluded)

Some central stations leave the customer the option between two or more different rates. We have then to consider for each customer only that rate which gives him the lowest bill, and the model for the combination of the optional rates will be a combination of the models of the opinional rates in such a way that only that surface is selected which has the smallest ordinate for the respective customers' point p. To show this in a sample example, let us assume the two optional rates would be:

(a) A straight 12c per kw.-hr. rate

(b) A rate under which each customer has to pay $1.80 for each kw. of his maximum demand, and on top of this 6c per kw.-hr.

These two rates are represented by Figs. 10 a and 10 b, and it can be readily seen that if combined in the manner indicated they will result in Fig. 8 b. (The shaded areas in Figs. 10 a and 10 b are those parts of the surfaces which do not apply, being higher than the corresponding part of the other optional surface.) Therefore, the multiple rate described in Fig. 8 b is identical with the system of optional rates just mentioned.



The eminent usefulness of a proper rate analysis is clearly demonstrated in the following example, which is taken from actual practice.[1] Under this rate the consumer had to pay a certain monthly fixed charge f cents per kw. maximum demand; let us say $4.00 per kw. (f = 400). This entitles him to use current up to the load factor L; (for instance, L = 300 hours' use of the maximum demand) the excess to be paid at z cents per kw.-hr. (for instance, 2½c per kw.-hr.). Without mathematical analysis, this rate looks perfectly correct and harmless, and it was not until the customers, themselves, happened to find out the defects and took advantage thereof, that the rate was revoked. With a little mathematical analysis, as follows, or a construction of a model, the defects of the rate would have shown up glaringly at once, and the rate would never have been put into effect.

In the range of load factors smaller than L hours (300 hours) we have $a = f\,d$, where a is again the customer's bill, and d his maximum demand; and if L is larger than 300, the customer with a total energy consumption of e kw.-hrs. has to pay, on top of this, for the excess of e over L d kw.-hrs. at the rate of 2.5c per kw.-hr., so that his total bill will be:

$$a = f\,d + (e - L\,d)\,z$$
$$= (f - L\,z)\,d + e\,z \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The first term on the right side is proportional to d, and independent of e; the second proportional to e, and independent of d. Consequently, $f - L\,z$ is the equivalent demand charge, and z is the equivalent energy charge in the range of load factors larger than L hours.

Substituting now the above values from the schedule for f, L and z, we get

$$a = (400 - 300 \times 2.5)\,d + 2.5\,e$$
$$= -350\,d + 2.5\,e.$$

We have a **negative** demand charge of $3.50 per kw.! In other words, all the customer has to do, in order to reduce his bill—provided he has a load factor of more than 300 hours' use per month—is to **increase** his maximum demand before the meter reader comes, and he will get a reward of $3.50 for each kw. of increased demand, until he has reduced his load factor to 300 hours per month. For instance, let us assume his demand meter reads 50 kw. at the end of the month, and his kw.-hr. meter 30,000 kw.-hrs.; his bill therefore would be

$$50 \times 400 = 20{,}000\text{c}$$
$$(30{,}000 - 50 \times 300) \times 2\tfrac{1}{2} = 37{,}500$$
$$57{,}500\text{c} = \$575.00$$

If he now, before the meter reader comes, for a short time on purpose puts on a heavy load on his motors, or for instance lets them all work simultaneously (instead of the diversity they show under ordinary operation) and thus runs his maximum demand meter up to 80 kw. with a practically unchanged kw.-hr. consumption, he will have to pay

$$80 \times 400 = 32{,}000\text{c}$$
$$(30{,}000 - 80 \times 300) \times 2\tfrac{1}{2} = 15{,}000$$
$$47{,}000\text{c} = \$470.00$$

He has increased his demand by 30 kw.; therefore his bill must be smaller by $30 \times \$3.50 = \$1.05$. This reduction of the bill with increasing maximum demand of course goes on until his load factor is reduced to 300 hours.

The model of this rate as given in Fig. 11, where the fact that the plane O S T is sloping downwards with increasing demands d instead of upwards, indicates that the angle r is negative, and that therefore

[1] The figures are changed for obvious reasons, but in such a way that the characteristic features of the rates are preserved.

the demand charge y = tan r is also negative.

In order to correct this defect we would have to choose the constants f, L and z so that f > L z (see equation 1). We would thus, by decreasing the load factor L, get the plane S T', or by decreasing the kw.-hr. charge z alone, S' T would result, or we reduce both L and z, and get S" T"; an increase of f finally with constant z and constant L would result in S T"', etc.

Minimum bills are represented by horizontal planes; for instance, the rate Fig. 8 b with the additional feature of a minimum bill of $1.00 per month would change into Fig. 12. In the range of the minimum bill we have again a special case of the three-charge rate system, that is with both y and z = O.

A minimum bill proportional to the demand (for instance, a minimum of $3.00 per kw. of demand) is given by a plane passing through the origin O and the axis of energy consumption O E, that is, plane O R S in Fig. 13. It means a three-charge system with x = z = O; that is a flat demand rate in the range of that minimum. By comparing Figs. 13 and 5, we see at once the difference between a minimum charge per kw. on the one hand, and a charge per kw. on top of which the other charges are made. Fig. 14 represents a model of a multiple rate with a primary charge of 9c per kw.-hr. for the first 6 per cent load factor; 7c for the next 6 per cent, and 4c for the balance. This rate, therefore, is, as it were, an extended Wright rate, with a primary, secondary and tertiary charge. The minimum bill is $1 per kw. per month.

If we intersect the rate model with a vertical plane parallel to the axis of energy consumption; for instance, with D Q R S T in Fig. 13, we get a curve R S T, giving the ordinates of the bills of all customers who have a maximum demand = O D, as function of their energy consumption, and since in this curve we have a fixed maximum demand, the energy consumption is proportional to the load factor, and the distance measured in the direction D Q therefore will also represent load factors. For the same reason, we can also take the ordinates (with a change of scale) as revenue from the customer per kw. maximum demand (or kw. connected load, etc., as the case may be). The solid model, therefore, also directly shows the income from the customer per kw. of demand plotted against load factors. Since the central station's capacity can be assumed to be roughly proportional to the capital invested, the income per kw. has a more immediate bearing on the interest of the capital invested (especially in water power plants with high demand and low operating expenses) than the ordinarily chosen figure of cents per kw.-hr.

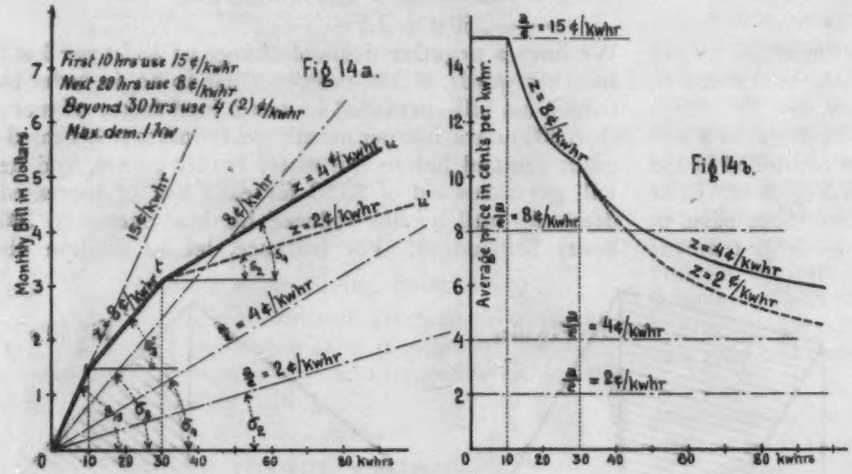
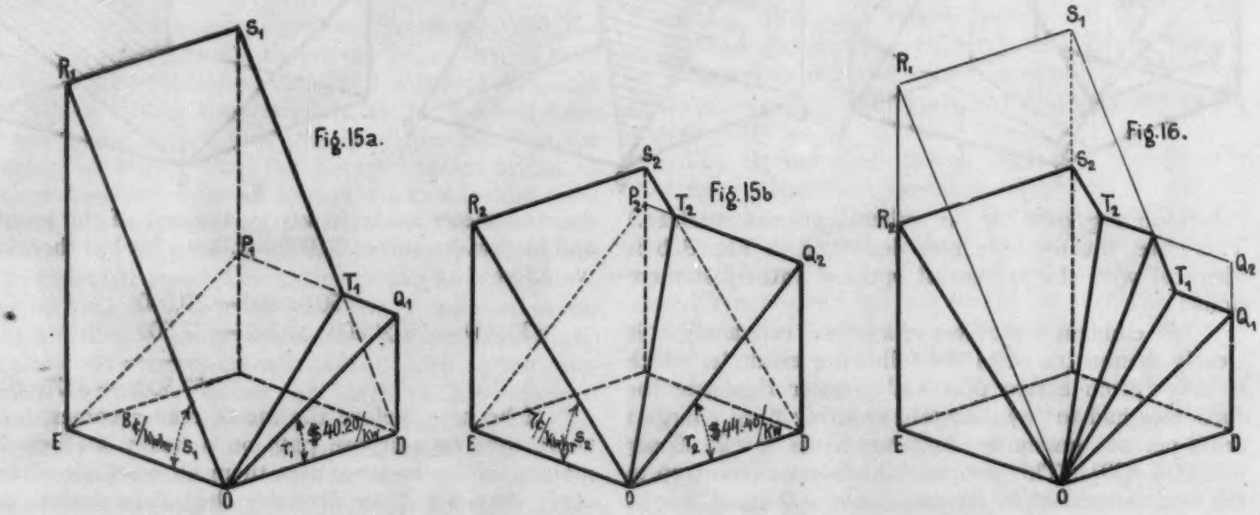


Fig 14a.
First 10 hrs use 15 ¢/kwhr
Next 20 hrs use 8 ¢/kwhr
Beyond 30 hrs use 4 (2) ¢/kwhr
Max. dem. 1 kw
Monthly Bill in Dollars
z = 8¢/kwhr
z = 4¢/kwhr
z = 2¢/kwhr
0 10 20 30 40 60 80 kwhrs
Fig 14b.
Average price in cents per kwhr.
= 15 ¢/kwhr
= 8¢/kwhr
= 4¢/kwhr
= 2¢/kwhr
z = 8¢/kwhr
z = 4¢/kwhr
z = 2 ¢/kwhr
0 10 20 30 40 60 80 kwhrs



Other Methods of Rate Representation.

This last named way of representing a rate graphically by using the average price per kw.-hr. as vertical ordinate is used by all other methods of graphical rate representation. The most widely used method of

graphical representation is a two dimensional one by plotting a curve showing the average price per kw.-hr. against the load factor for a certain definite maximum demand, and preparing such curve sheets for a number of definite figures of the maximum demand. By setting these curve sheets (one for each maximum demand) one behind the other in space so that their planes parallel, and at the proper distance, we obtain a solid body to represent the rate, with the three axes representing kw.-hrs., load factor and average cents per kw.-hr.; (see, for instance, "Electrical World," November 4, 1911, page 1141, "Wholesale Rates for Electric Service at Cincinnati").

If we consider, however, the fundamental law of expenses of a central station as described above, the total cost of serving a customer is composed of, first, one part caused by the demand only and proportional thereto; second, of another amount caused by the energy consumption and proportional thereto; and third, of a constant amount, and we see that the fundamental primitive determining variables are **dollars** (or cents), **kilowatts** and **kilowatt-hours**; average price per kw.-hr. (cents per kw.-hr.) and load factor (kw.-hrs. per kw.) are only secondary factors derived from the primary ones by division:

$\frac{\text{Total bill}}{\text{kw.-hrs.}}$ and $\frac{\text{kw.-hrs.}}{\text{kw.}}$. The relations between these "primary" factors—a, d and e—are equations of the first degree in case of the three-charge system and its special cases. That means the rate is represented by planes (or straight lines in two-dimensional representation); rates represented by curved surfaces are very rare exceptions.

On the other hand, with the older systems (average price per kw.-hr. and load factor) we get complicated curved surfaces of the second order, hyperbolic paraboloids, etc. (and even surfaces of the third order) for the simple three-charge system.[1] In case of a two-dimensional representation the resulting curves are mostly hyperbolas. (Only in case of the straight kw.-hr. rate, which hardly needs any geometrical representation at all, we get planes or straight lines respectively.)

The tangents of the angles of inclination of the planes towards the d and e axes immediately show the price of each additional kw. and kw.-hr.; in other words, the kw. and kw.-hr. charges, whereas with the other method (cents per kw.-hr. as ordinate) we get curved lines which do not indicate anything at all to the eye about the **nature** of the rate. If, for instance, in the multiple rate which is represented by both Figs. 14 a and 14 b, we change the price per additional kw.-hr., that is, the kw.-hr. charge (not to be confused with the average price per kw.-hr.) in the tertiary range the straight line tu will change into tu', which immediately by its direction indicates the nature of the change, whereas, the corresponding new curve in Fig. 14 b (apart from its much more complicated way of construction(does not say very much to the eye, except that the rates are now lower, and it does not show the new law of the rates.

[1]The same is true for a system of co-ordinates of demand, energy consumption and average price per kw.-hr., which system has been introduced by the author in his serial article "Some Geometrical Aspects of the Three Charge Rate System" (Electrical Review and Western Elec., February 11th, 18th and 25th, 1911, Figs. 7 and 8a-8m).

If the rates are represented by the "total bill — kw.-kw.hr." co-ordinates, the derived functions of load factor and average cost per kw.-hr. can be easily found, if desired, as tangents of angles between straight lines or planes as shown above—relations which are so simple that in many cases for comparing values we need not even draw the lines actually, but imagining their position on the paper or in space gives us the information wanted. Conversely, however, if we want to know how large the total bills are under the "average price-load factor-kw.-hr." system, we no more have such simple graphic relations for the transformation.

If we compare one rate to another in its effect to a certain customer, we compare what his bills would be under both rates, and also from this point of view the system of choosing the total bills as ordinates seems to be more direct than the other one.

Rates With More Than Three Variables.

Even in those rare cases when the rate schedule contains a fourth variable—which usually is a guarantee on the part of the customer—one can represent the rate by a three-dimensioned model under certain assumptions. Take, for instance, the business lighting rates in use in one of the large cities on the coast; the customer gets a rate of

8c per kw.-hr., subject to an annual guarantee of $40.20 per kw.
7c per kw.-hr., subject to an annual guarantee of 44.40 per kw.
6c per kw.-hr., subject to an annual guarantee of 48.00 per kw.
..... etc. .....

The annual guarantee of $40.20 per kw. is represented by a plane of the type Fig. 4, that is O E P_1 Q_1 in Fig. 15a, where tan r_1 equals $40.20 per kw. per annum. The 8c per kw.-hr. rate, on the other hand, is represented by O D R_1 S_1, tan s_1 equals 8c per kw.-hr. The customer is charged according to plane O D R_1 S_1, provided he does not get below O E P_1 Q_1. Therefore, of each plane, only the heavy outlined parts must be used (O R_1 S_1 T_1 Q_1). If the customer, however, guarantees $44.40 instead of $40.20, we get plane O E P_2 Q_2, Fig. 15b, at a steeper inclination r_2 than O E P_1 Q_1),[1] (tan r_2 = $44.40 per kw.-hr. per annum) and O D R_2 S_2 at a smaller angle s_2 corresponding to 7c per kw.-hr. If we now assume that each customer chooses his guarantee correctly, that is so that he gets the smallest bill possible under the rates, we have to combine the two heavy outlined surfaces in Figs. 15a and 15b into a single one in such a way that for every point on the bottom plane we select the surface with the smaller vertical ordinate, and thus arrive at Fig. 16.

By applying the same method for all steps of the yearly guarantees of the schedule, we finally get the model in Fig. 17, which also shows the additional feature of a discount which is given only if the bill is larger than $100 per month.

Tar as a Fuel for the Diesel Engine.

Tar oil has become a more or less common fuel for Diesel engines of 600 or 800 h.p. rating and it is understood that tar is used in at least one engine of 4000 h.p. rating. Recent experiments indicate that both thin gas-retort tar and thick oven tar can be used by injecting into the cylinder a small percentage of light oil to assist in igniting the tar.

[1]The relations between the drawings 15a and 15b, are on purpose exaggerated, and not to scale.

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Western Manufacturing Opportunity

For sixty years the West has been a producer of raw materials and a consumer of manufactured products. In its zeal to export its natural wealth it has failed to exploit its manufacturing advantages. Few of the manufacturies which have been established to supply local needs have been managed with that business acumen which has enabled Eastern manufacturers' agents to control the tremendous buying power of Western communities. The reasons for this neglect were good and sufficient in their day. But that day is passing.

Nature has been equally as bountiful in supplying manufacturing facilities as in furnishing raw materials. With splendid natural harbors at Puget Sound, the Columbia River, San Francisco Bay and San Diego and the excellent artificial ports at Los Angeles and other localities, the ships of all nations can find ample anchorage and provide cheap transportation to and from the markets of the world.

The first half century of Western development was accomplished without the aid of cheap fuel. This lack applied the needed spur that forced the utilization of its protean water power and now, with the development of its latent oil resources, the combination of oil fuel and water power enables the West to compete in the manufacturing field in every essential factor excepting cheap labor. The latter will be a concomitant of the early opening of the Panama Canal, which will bring the skilled workmen of other countries to a land where climatic conditions allow them to work comfortably every day in the year, surrounded by conveniences and liberties not to be found at home. This will give to the Pacific Coast the same commanding position that the Atlantic seaboard has enjoyed for many years in receiving direct immigration.

Comparison shows that the manufacturing rank of the various states closely approximates to their relative population. The Pacific Coast states have borne out this ratio in the past and it is fair to assume that the present rapid increase in population will coincide with an equally rapid increase in the value of manufactured products.

Although agriculture and mining are likely to long continue as the principal industries of the West and lumbering and the preparation of food products the most important manufacturing interests, other concerns are rapidly taking root,—cement plants, foundry and machine shops and oil refineries. Along the line of electrical manufacturing, Southern California is the home of one of the largest makers of electric heating appliances as well as the site of a growing motor works. On San Francisco Bay there is a large cable manufacturing plant, an important lamp making industry and several switchboard manufacturers. A porcelain plant is just being established to turn out electric fittings, a calcium carbide works is nearing completion and a new carbon company is nearly

ready to market its wares. The Northwest is still chiefly concerned with lumbering although a manufacturer of electrical fittings is meeting with success.

Central stations would find it greatly to their interests to co-operate with the chamber of commerce, or other commercial organizations of the various towns they serve, in advertising the resources of the region, not only on account of the cheap power they can supply to off-peak consumers but also on account of the natural products which can be converted into manufactured articles.

It will not be many years before the intensified cultivation of Western farms will require artificial fertilization whose constituents of phosphorus, potassium and nitrogen can best be won by the aid of electricity. Many other equally valuable industries, particularly in the manufacture of such human necessities as clothing and food products, as well as the refining of metals, can be more economically conducted in the West and thence cheaply carried to the markets of the world.

Electric Railway Franchises

The vexing question of new franchises for electric railway extensions into outlying districts has been engaging the attention of the municipal authorities at Seattle and Portland for some months past. In several instances the street railway officials and those of the cities have practically come to a dead-lock and no relief is in sight until the city charter is amended or a new one adopted and the provisions put into effect. The property owners demand that service be extended into thinly populated territories, while the municipalities either place such exorbitant valuations or exact such unreasonable terms that the railway companies refuse to do the new work on the ground that it cannot be financed.

A city's future prosperity is dependent upon adequate transit facilities, for which it must rely on private enterprise. But capital will not respond unless a merchantable franchise is offered. The street railway business is one which constantly calls for new money and under the present limited returns on investment, it is yearly becoming more and more difficult to interest investors.

It is the engineer who blazes the way and digs the ditch for capital to enter a new territory. Capital is a fluid body which follows the path of least resistance. Dam it with restrictive legislation and it is diverted to more lucrative fields. Recent laws in many states promise to hamper profitable investment, particularly in public utility projects, and at once a marked exodus of path-finding engineers is noted to new fields. The projects they investigate will appeal more strongly to the men of money than do those at home and as a consequence capital will not be available to carry out local requirements.

Public-favor-currying politicians propose that fares be arbitrarily reduced from five to three cents in the face of the fact that the cost of almost every class of material entering into electric railway construction has recently advanced to such a point that a six-cent fare would be more logical. The politician's first idea of statesmanship is that "the government exists to pay salaries and the more salaries the better," and so he is continually advocating municipal ownership, the municipality being given the right to acquire the investors' property at any time it may see fit without any valuation being placed on the franchises. Under such conditions the public should not blame the company for refusing to make extensions of doubtful earning ability.

The extremes to which such exactions may proceed is exemplified by the recent drastic ordinance of the Chicago city council that prohibits a traction company from displaying advertising matter either in its cars or at its stations because such privilege is not definitely assigned in the provisions of the franchise. How much wiser would it be merely to amend that instrument!

At Seattle a committee has been appointed from the franchise committee of the city council and the various commercial and municipal clubs to assist in drafting an amendment to the present city charter on the subject of street railway extensions. Until this action is completed little relief is to be expected.

At Portland the franchise matter first came up last fall when the electric company requested a blanket grant for many lines which it was not anxious to build on account of the large expenditure involved, but was willing to concede to the demand of the property owners. After several months of futile effort to decide the terms of the proposed grant, the street committee recommended to the council that the franchise be granted, but since that time so many obstructions have been interposed that the company cannot see its way clear to accept the proposed terms. The extensions are mostly stub-ends of the general franchise and are loaded up with restrictions and regulations that are not included in the main franchise which has yet many years to run.

The ultimate solution of these questions appears to rest with the complete surrender of municipal control of public utilities to a state commission. Washington and California already have such bodies, while Oregon will probably adopt a similar policy this year. State control should be independent of franchises heretofore or hereafter granted by cities and be based upon uniform rulings. In order that the cities and their citizens may gain the advantages to be derived from increased transportation facilities would it not be the course of wisdom to remove the obnoxious restrictions at once and depend upon future commission decisions to regulate rates and taxes for revenue? These are questions which should be settled upon a fair and just basis by men of experience, responsibility and fairness.

PERSONALS.

C. L. Cory has returned to San Francisco after an outing in the Yosemite Valley.

J. V. Kunze, manager of the Atlantic department of the Pelton Water Wheel Company, is on his way to San Francisco.

R. A. Bowden has been appointed sales manager for the San Francisco division of the Great Western Power Company.

Thomas Mirk, of Hunt, Mirk & Company, has returned to San Francisco from Tahoe Tavern, where he made a short stay.

George E. Bunker, president of the Ontario Light & Power Company, is a recent arrival at San Francisco from Uplands, Cal.

Addison Day, assistant secretary of the Los Angeles Gas & Electric Company, has been spending a vacation at Lake Tahoe.

H. V. Carter, president of the Pacific States Electric Company, visited Los Angeles during the past week, stopping over at San Jose on the return trip.

A. W. Bullard, vice-president and general manager of the Great Western Power Company, returned to San Francisco during the week from a southern trip.

Thornwell Mullally, the assistant to the president of the United Railroads, has returned from an Eastern trip in connection with the purchasing of additional electric cars.

Wynn Meredith has just returned to San Francisco after visiting British Columbia in connection with the work which Sanderson & Porter are supervising on the Victoria water supply.

A. E. Barlow, general sales manager on the Pacific Coast for the American Ever Ready Company will leave Seattle about August 1 and thereafter make his headquarters at San Francisco.

Fred L. Webster of the Allis-Chalmers Company has returned to San Francisco after visiting Los Angeles on business. **E. A. Quinn**, of the electrical sales department of the company, is visiting Seattle.

Frank Fowden, manager of the Brooks-Follis Company, visited Portland during the past week. After attending the Electrical Contractors' Association convention at San Jose, he will make a trip to Salt Lake City.

E. E. Carpenter, formerly resident engineer in charge of the hydroelectric development of the Jordan River for the British Columbia Electric Railway Company, has been appointed civil engineer for the Panama-Pacific Exposition.

S. K. Colby, vice-president of Pierson, Roeding & Co., and **Joseph Hanna**, representing the Niles Car Company of Niles, Ohio, are at Portland in connection with opening bids for the Oregon Electric Railway's new cars.

J. A. McMonies has been appointed manager of the electric appliance department of the Great Western Power Company. An extensive display room is being fitted up on the ground floor of the general office building at 233 Post street.

W. S. Hanbridge, secretary of the State Electrical Contractors' Association, returned to San Francisco during the week, after attending the annual convention of the National Electrical Contractors' Association at Denver, July 17th to 19th.

M. R. Starring, president of the United Railways Investment Company, and **J. H. Reed**, president of the Railway Companies of Pittsburg, are at San Francisco in consultation with **Patrick Calhoun**, president of the United Railroads, and **G. W. Bacon**, president of the Sierra & San Francisco Power Company.

Heinrich Homberger has returned to San Francisco after visiting Los Angeles on some expert work. He recently conducted tests at the Borel power station of the Pacific Light & Power Corporation. The 4000-h.p. turbines manufactured by the Pelton Water Wheel Company were found to give complete satisfaction.

Ralph Clapp and **C. D. Lamoree**, salesmen connected with the Westinghouse Electric & Manufacturing Company's Los Angeles office visited San Francisco office of the company before attending the annual convention of the State Electrical Contractors' Association at San Jose.

J. D. Beebe has resigned his position as manager of the office of the Pacific Power & Light Company at Prosser, Washington, to become construction engineer with the Arizona Copper Company, at Clifton, Arizona. His place at Prosser has been taken by **W. E. Gay**, of North Yakima.

H. W. Crozier has been elected chairman of the executive committee of the San Francisco Section of the American Institute of Electrical Engineers and **A. G. Jones**, secretary. **P. T. Hanscom** is chairman of the papers' committee, **C. L. Cory** of the membership committee and **A. H. Halloran** of the entertainment committee.

J. L. Crider has resigned as chief engineer of the New York, Westchester & Boston Railroad to become superintendent in charge of the new construction work on the Oakland, Antioch & Eastern Railway and will also act in a consulting capacity on the Oakland & Antioch, which is approaching completion.

Robert Strahorn has been made vice-president and general manager of the Portland, Eugene & Eastern Railway, which is the name under which the Southern Pacific Company is electrifying 200 miles of existing steam roads in Oregon and constructing 100 miles of electric road. Offices have been opened in the Wells Fargo Building, Portland.

J. H. Wise, assistant general manager of the Pacific Gas & Electric Company, and **Fred S. Myrtle**, head of the publicity department, inspected the work in progress on the hill and at the Lake Spaulding dam during the week. An army of men is at work on the hydroelectric development which will require about two years, for its final completion.

Julian Woodridge, of Ford, Bacon, Davis, returned to San Francisco during the week after an inspection of the extension of the transmission lines of the Sierra & San Francisco Power Company's line from Alviso to Salinas, eighty miles, and the Coast Valleys Gas & Electric Company's line from Salinas to King City, a distance of fifty miles, making the total distance covered 130 miles. **H. F. Jackson**, general manager of the two companies, also visited the scene of operations recently.

A. E. Barlow, general sales manager of the American Ever Ready Company on the Pacific Coast, under President R. F. Oakes, after having had his headquarters at Seattle for a number of months, will arrive at San Francisco, August 1, and will thereafter be located at Factory No. 8. R. F. Oakes contemplates motoring with a party to Lake Tahoe and spending the month of August in that vicinity. Business in dry batteries is very active with the Ever Ready company, and night work is necessary at the San Francisco plant. The flash-light season will soon open.

TRADE NOTES.

Hunt, Mirk & Company will proceed with the installing of a low-pressure steam distribution system for the United Light, Heat & Fuel Company at San Diego. Steam will be obtained from the power plant of the San Diego Electric Railway Company.

The Pelton Water Wheel Company have made the initial shipment of portions of the three Pelton-Doble tangential water wheels for the hydroelectric plant that is being installed in connection with the Los Angeles aqueduct project. Each generating unit is to be of 10,000 kw.

A contract was recently awarded by the United Railroads of San Francisco to the J. G. Brill Company, represented on the Pacific Coast by Pierson, Roeding & Co., for 65 P. A. Y. E., California type, cars, including Brill trucks. The cars will be similar to the new "700" type now in operation on the Mission and Fillmore line. The steps will be lowered for the convenience of passengers.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

DENVER CONVENTION OF NATIONAL ASSOCIATION.

The twelfth annual convention of the National Electrical Contractors' Association was held at Denver, July 17-19, 1912. The directors and executive committee met in joint sessions at 10 a. m. on the morning of July 16 with President M. L. Barnes in the chair. A great deal of important business was transacted, including the reports of committees. Directors were present from thirteen states, Illinois and New York each having three, California two, and the balance one.

At 10:30 a. m. Wednesday, July 17, President Barnes called the meeting to order in open session. The speakers were W. P. Carstarphen, M. L. Barnes, Gov. John F. Shafroth, Mayor Henry J. Arnold, Mr. Maurice B. Bisco and Mr. Alva F. Traver. In the afternoon a business meeting was held and during a recess Mr. Philip S. Dodd spoke on "Co-operation." The ladies were given a sightseeing trip around Denver in auto-buses. In the evening a Sons of Jove Rejuvenation was held and a class of twenty-one were introduced into the mystery of Jovianism. At 9 p. m. a reception and a dance were given and a very pleasant evening spent. The California delegates distributed one thousand 1915 badges and California poppies and it is needless to say that everyone wore California colors.

Thursday was devoted to closed sessions. A committee from the Jobbers' Association was present and presented a paper, a copy of which follows this account.

Thursday noon the members of the association and their ladies were the guests of the Denver Electrical Club, about 500 people sitting down to luncheon.

Thursday night the annual dinner was given with an attendance of 250. A roll call of the charter members was held by E. V. McCleary and only nine of the original fifty responded. Mr. McCleary then spoke of the good work done by President Barnes and presented him with a silver service in behalf of the members throughout the United States. The retiring president was very much affected and spoke a few words of thanks. A vaudeville entertainment was given, and while Jas. Strong is no mean artist, still Jas. Wilton shows he can look out for the welfare of all.

Friday's trip to Corona over the Moffatt Road was a success and one that will never be forgotten by the members of the N. E. C. A. Luncheon was served on the train and it was one continual gasp of appreciation as the beautiful panorama was unwound as the train moved along toward Corona. A fine time was had snowballing. Photos were taken at Corona on a snow bank and also at Yankee Doodle Lake. The crowd reached Denver happy and tired to take their train for home.

The officers elected to serve during the ensuing term are: E. Freeman, president; H. S. Potter, first vice-president; J. C. Hartzel, second vice-president; W. Martin, secretary; W. L. Hutchinson, treasurer; J. C. Stearns, sergeant-at-arms.

To the California members who are making their first trip to a National convention, the proceedings were very interesting, and they were very strongly convinced of the necessity of supporting the National in the good work they were doing.

ELECTRICAL CONTRACTORS' ASSOCIATION NOTES.

The Butte Electric Company was the lowest bidder on the signal system for the County Hospital, their bid being $12,900. Other bids went as high as $14,400.

The Decker Electrical Construction Company was awarded the electric work for a new hotel building being erected for James Phelan on Market street near Seventh.

RELATIONS BETWEEN ELECTRICAL CONTRACTORS AND JOBBER.[1]

BY W. S. BISSELL.

In the electrical field a condition exists, not true of all businesses, in that the term "contractor" is also a synonym in most instances for "electrical dealer or retailer." I preface my remarks by assuming that your program committee wish me to bear this distinction in mind.

It is a little embarrassing to talk to the subject of the Relations between the Contractor and the Jobber, for it would seem that the interests of both are so intertwined and identical as to permit of but little discussion. Surely the jobber is vitally interested in the success of the contractor, and therefore a condition is created that marks a step on his part towards the closest and most friendly relationship.

The jobber is also prone to believe that this friendly feeling is generally reciprocated by the contractors as a whole, and speaking for the Association we represent, our committee carries to you a message, not only of the pleasure at the opportunity of meeting with you, but a true appreciation of the courtesy and kindly feeling evidenced by your invitation.

What is the relationship that does or should exist between the contractor and the jobber? There is no alliance in the strict interpretation of the word nor can there be, as I understand it, between the two Associations.

But, in the very nature of things, there can and does exist a co-operative relationship, and these two words sum up the situation.

The jobber stands today committed to your own resolution that the natural course of merchandise is from manufacturer to jobber, then to the contractor, central station, etc., and then to the consumer. Surely it is only through co-operative measures that this channel may eventually be marked so well that no manufacturer, jobber or contractor will care to deviate from its course.

The jobbers' desire and willingness to co-operate with the contractor and other allied interests is also evidenced by their resolution authorizing the purchase of a supply of wiring handbooks, to be distributed pro rata among the jobbers so that they, too, might be identified in helping with good work.

True, this co-operative tie that binds your business and ours has not as yet been pulled taut, and the distance between the jobber and large contractor is still great. But the trend is in the right direction, and while ideal conditions may never be possible, we can and should be closer together than we are now.

Just how or when this will be brought about I cannot tell you, but that it will come as the natural economic answer I am firmly convinced.

Both contractor and jobber working together can, however, "speed the day," and as such action is more desirable, let us cast around for the obstacles now lying in our path.

Looming up like a lighthouse is the trite cry of "eliminate the middleman." This may not be a popular clamor today. We doubt it. For while acknowledging some noise instigated by certain papers and magazines, it seems impossible that the people, who are always right, after careful consideration can help but see the fallacy of the argument. If successful, it would simply increase the cost of distribution and retard matters by just that much additional expense, which in the end the public must pay.

Taking up the subject from the standpoint of the jobber and the contractor, we acknowledge that there are those

[1]Paper presented at 12th Annual Convention, National Electrical Contractors' Association, Denver, July 18, 1912.

among your organization who disagree, but these we feel are individual companies who cut their cloth by conditions that may exist in their particular localities.

Looking at the matter broadly, surely the concentration of merchandise drawn from north, east, south and west, the shipping facilities, and the ability to make small or large assorted shipments, and many of them are, and always will be, potent reasons why the contractor will always need and use the jobber as his source of supply.

To carry the argument further, is not the contractor relieved of an excessive merchandise investment with the consequent opportunity to devote part of his funds elsewhere to better advantage, and if of limited resources can he not and does he not turn to his jobber for financial assistance?

A lawyer will tell you that no man should plead his own case, and rather than jeopardize the interest of the jobber, I quote here a letter from a manufacturer that has been brought to my attention:

"It has been our experience, and it is our settled conviction, that the user can do very much better to purchase from the jobber than he can from the manufacturer. This may at first seem strange to him, but nevertheless, it is a fact, which experience will demonstrate, we believe, in every case.

"The manufacturer is usually at a long distance from the user; he is manufacturing only one line of material, and he cannot by any possibility afford to study the requirements of the user by sending his traveling man to them and by cataloging the things they require, which is possible on the part of the jobber, only through the fact that he handles the entire line of the user, so that the expense of maintaining a stock adjacent to the user, of issuing catalogs and price sheets for his information and assistance in buying, and of sending traveling men frequently to discuss with him his needs, is only possible because the jobber is able to spread expense of all this procedure over the entire line of material which the user requires, and thus the percentage on each individual item is very small, where it would be very large in the case of the manufacturer. The jobber's profit, from our understanding of the matter, is made out of the user whose requirements are small at any one time. Such requirements the manufacturer could not take care of at all, as they would be too much trouble for him to consider doing so at any price. When it comes to the large user, however, and especially to the user who buys in carloads, and where shipment is made direct from the factory, the jobber takes care of such business on a margin which the manufacturer could not begin to do at any profit whatever. For instance, on a carload of material, such as you require, the jobber's profit is actually about 3 per cent, and for this he sends out his catalog to you; gets you the prices; studies your requirements; acts, in a sense, as an arbitrator between you and the factory if any difference of opinion arises; carries the account, as a manufacturer at a long distance would not want to do and, on the whole, gives you at least double the value of the difference in price that you have to pay over what the jobber would pay. On the other hand, any manufacturer who would sell you at all would charge you for equal quality material at least as much as your local jobber would charge you, and under these conditions we believe that it is the duty of the user to support the jobber in his vicinity, building him up in this way, so that he will be in position to supply the users' emergency requirements which no factory could take care of, and which the user would be in very bad shape, for if it were not possible for the jobber to supply him quickly."

If for nothing else do not these reasons alone make our mutual success much to be desired and draw us both, contractor and jobber, together in closer relationship?

In just such a relationship lies the strength of the situation as a force is created that is practically irresistible; while failure to work together only helps to make conditions worse. We are both facing toward the common goal—improved relations with the manufacturers. The situation now is bad for both, more so for the contractor than for the jobber, but how are we going to better it if our forces are divided? Why not march together, side by side?

Another obstacle is the jobber who is a contractor, and another, the contractor posing as a jobber. This is a condition that can be handled locally and will be eventually straightened out through co-operative measures, promoted by the Sons of Jove, luncheon clubs, etc. But both are thorns in the flesh, and as they loom large on the broad field as the manufacturer sees it should be considered here.

These deterrent elements deserve no encouragement from either of their associations. Yet each man points to the other as the influence that affects his policy; each claims the necessity of fighting fire with fire. As a result, neither develops his respective field to its full possibilities and are both immeasurably handicapped by divided interests.

If this last were not true there is no reason why the whole electrical field could not be controlled by one or two companies. In view of recent developments it may be that we are tending that way. It is something to think about.

If the danger signal is there isn't it time for a closer reciprocal relation and a well established understanding as regards the dividing line between the jobber and contractor?

It certainly is not the time for the contractor to withhold patronage from the jobber. The jobber, too, must live, and the disappearing roles have not as yet been definitely assigned.

Are prevailing "quantity prices" another obstacle? They may or may not be. There is a chance for argument. We believe they stand for good. One thing is certain. They are fixed. They are essential. Quantity always has made the price and always will. It protects the big buyer and still is fair to the smaller brother who, buying from hand to mouth, deserves his chance to prove his ability and forge ahead, if he can, from curbstone operation to the larger organization with its increased expenses and responsibilities. The trouble lies not so much in the "quantity price" or "sliding scale" itself as it does in the dissatisfaction it creates, its abuse and in attempts on the part of some to break down through demanding the large lot price and buying in smaller quantity. The contractor alone has not been guilty in this respect, yet if we each could see the futility and inadvisability of such effort and individually decide to give our own support to those who offered this protection the situation would be simplified.

Dissatisfaction exists in the knowledge of a differential in which possibly you or I are not participating. What difference does it make, provided we are on an even footing in our class?

The contractor deserves and is provided with a margin on his purchases and should not the same rule hold good for the jobber, too? We think so, but seldom do we hear such argument advanced from the contractor's side of the fence.

The abuse of "quantity prices" lies in the fact that some of us are our own worst enemies. That some take advantage of the differential, but instead of placing the money in their own pockets where it belongs, foolishly or ignorantly give it away in cut prices. This is particularly true of the contractor, who, mistaking the jobbers' pasture as the "Elysian fields," thinks that he enters them through selling below the prevailing manufacturers' re-sale and in that way antagonizes others and loses money for himself. None of which spells harmony or leads towards co-operation.

The answer is to be found in education. At least some have found it so. Teach or influence every man to figure his actual costs and know. It is just this failure to figure cost of operation that results, be he jobber or contractor, in a selling price below the real cost of doing business.

There is nothing more illuminating than the discovery that a big percentage of one's operating charges are placed against business averaging but little in the aggregate. Discoveries like this are the kind that lead to quick revision of one's re-sale of percentage of profit figured.

As business men, you would consider it suicidal to open a new bank account every day and poor policy to have three or four bank accounts in the same town. The contractor's position with the jobber is in many instances the same as that of any business depositor with his bank. For obvious reasons this condition seldom if ever exists between the

contractor and the manufacturer. If the analogy holds good is it not in order for the jobber to point out here that a good account in one bank brings the accommodations that could not be secured under other conditions. Yet it is this very situation that presents an obstacle that the jobber, and I believe your association, are among the first to deprecate because an unnatural, untenable, and needless business policy that the contractor should not countenance nor the jobber have to offer. And while admitting that such subsidizing is wrong, has it not in many instances been developed through the failure to co-operate on the part of the influential contractor, who in that way forces the jobber to develop a market of his own that may or may not be of a caliber that will prevent the first class contractor from making any money on about 90 per cent of his jobs.

Another obstacle that blocks the way to the contractor's success and for that reason has a bearing in this paper, is the competition from the central stations, due not so much to their distributing, but to the giving away of current-consuming articles or the selling below cost. Happily, conditions are rapidly being bettered in comparison to what they were throughout the country.

We think that more and more as the lighting companies grow familiar with merchandising, as distinguished from engineering, that they will realize that the way to sell lots of current and make money out of it is to stick to the current, and if necessary reduce the price of "juice," which, after all, is the best, quickest and most prominent way to "popularize electricity."

Besides that a saving in expense will be effected by not trying to run a selling department which can be better taken care of by those entirely outside and separate from the lighting organization.

But even where the lighting people insist on maintaining this department let them sell at a profit and their success will be great, like that of a company recently reported in the trade papers, which in changing from a policy of selling at cost, to that of a profit, not only increased the number of appliances and kw. sold but made a profit in place of a loss that before had averaged $6 per kw. in securing appliance business.

These same conditions hold true as regards lamps. While it may have been necessary at one time, surely large central stations are today no more required to distribute lamps than they are heaters, and certainly no reason for their sale below cost, or on the free renewal basis. Such a policy cannot qualify as co-operative in a field where it means so much to all concerned.

Still you all know the arguments the central stations have advanced that co-operation did not come from the contractor, that retail stores were not operated, that new ideas were not taken up nor aggressive salesmanship developed; that prices much too high were asked and that of necessity they were forced to adopt the methods used.

This may have been correct at one time, but is it true today? We think not. Certainly it behooves the contractor to conduct a retail store. Not only because the department store, hardware store, gas mantel store, and others are right now flirting with this trade, but because it is his bread and butter to keep in touch with the consuming public, let alone the fact that it is absolutely essential that he be in position to prove to the central station man that he has in the contractors a combined force of solicitors that can accomplish wonders if he will only use them.

Incidentally the central station which eliminates the contractor is in the same category as the manufacturer who goes direct to the consumer or contractor and, like all things else, will stop only when the situation is changed and conditions prove such action is no longer necessary.

That there is an evolution coming in the central station business no one doubts. In fact, it has already been claimed by good authority that in five or ten years the heating load will exceed the lighting load, and this with ventilation, and refrigeration, opens up a field of current-consuming devices of which the contractor who retails must, if consistent, and a good business man, as well, surely take advantage.

That he will do this is evidenced by the increased interest shown everywhere in store counter trade, the electric shops, the improved personnel of the selling organization, the better window displays and the higher grade and more judicious advertising.

Possibly it is through this development and co-operative effort lying before us that we may all, manufacturer, central station jobber, contractor and dealer, find our way out to the promised land, where the cloud called "lack of confidence" which seems to affect us all, will not exist.

Education, a better knowledge of merchandising methods, more stability from a credit standpoint secured by restriction of business to each man's financial capacity and the application of real business ability will all make for this solution.

Whether this be far off or near we do not know. But surely co-operation will carry us farther and whether the Moses to show us the way to better things be in your organization, or ours, the jobber is in a receptive mood and will follow any feasible step in the right direction.

To return to our own more intimate difficulties this is the thought I would leave with you. A manufacturer cannot be a jobber, a jobber a contractor, nor a contractor a jobber without assuming all the risks and responsibilities that accompany each business, and when he does the exclusive jobber or exclusive contractor has him hopelessly handicapped.

When the time comes for either the jobber or the contractor to be eliminated it will come when either one or the other has ceased to be useful. That time has not arrived.

FURTHER IMPROVEMENTS IN HOLOPHANE.

A new standard line of high efficiency reflectors will be offered shortly by the Nelite Works of General Electric Company. The new line will be known under the trade name of "Xtraficiency" and will not only be of considerably greater efficiency than present standard line Holophane reflectors, but will actually be the most efficient lighting glassware in the world. Electrical Testing Laboratories, photometric tests will be offered to substantiate this statement. In announcing the new line, Mr. W. F. Minor, in charge of the efficiency glassware sales of the Nelite Works, said:

"Now that we are in position to sell every type of illuminating glassware, we realize the distinct position of each type. At one time, the industry undoubtedly lost its head over Holophane—that is to say, the efficiency and ease of installation of our product was such that Holophane glass was frequently used in places where another type of glassware might have served to better advantage. The natural result of this over-enthusiasm for high efficiency glass led in time to an equally erroneous prejudice in favor of opal glass, so that today we see many installations equipped with our own opal or others which might better have been equipped with Holophane.

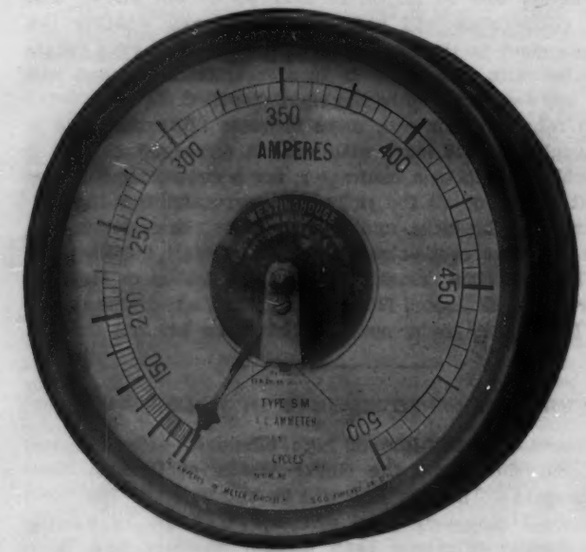
The new "Xtraficiency" line of Holophane glassware will help to define the proper place for each class of equipment. Where efficiency is the chief consideration, Holophane is without doubt the proper equipment. As decorative necessity or architectural restrictions call for more decorative glassware, the opals find a natural place. I think that in future we will not see prejudice in favor of any particular type of lighting equipment carried to the lengths it has been carried in the past, and that the glassware selected for each installation will be selected with a view to the exact requirements of the case and not in accordance with the ready-made arguments of the man making the installation."

INDUSTRIAL

INDUCTION TYPE SWITCHBOARD METERS.

Modern switchboard practice demands certain characteristics in indicating meters, without which they are unsatisfactory. These characteristics are: compactness, to enable a large number of meters to be mounted in minimum space; readability, to make possible the reading of a large number of meters from one point which necessitates also heavy damping; ruggedness, to prevent overloads and other abnormal conditions from throwing the meters out of calibration; and simplicity, so that repairs can be made quickly and without sending the meters back to the factory.

All these desirable characteristics are features of meters operating on the induction principle if properly designed.



Westinghouse 7-inch A.C. Ammeter.

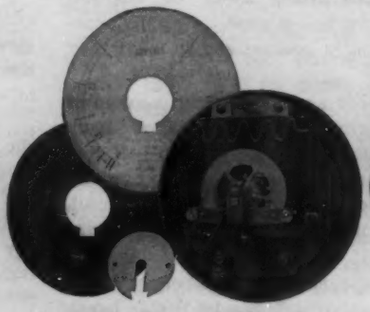
The induction meters recently introduced by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., have scales covering 300 degrees, thus securing 14½ in. scales even in meters only seven inches in diameter. The damping is such that the pointer does not pulsate or overswing the mark even with a change in load equivalent to full scale of the meter. All parts are very simple and rugged as can be seen from the accompanying illustrations. No moving coils or flexible connections are required.

The movement used in the ammeters consists of an electro-magnetic structure so designed as to produce a rotating field in an annular air-gap, and a pivoted light metal drum in this air-gap. The arrangement of electrical and magnetic circuits is such that a high torque is produced by induction in the pivoted drum, proportional to the square of the current in the primary winding of the meter (connected in series with the current transformer or the line), independent of temperature, wave form, or frequency within wide limits. This torque is opposed by the restraining force of a comparatively heavy spiral spring, so that the deflection is proportional to the square of the current. The scale is clearly legible from ten per cent to full scale.

Voltmeters use the same type of movement as the ammeters, but the primary winding of the meter is connected across the line, in series with a high resistance contained in the meter case.

By means of an aluminum disk mounted on the shaft and moving between the poles of two powerful permanent magnets, intense damping is obtained. As the torque of the meter depends entirely on the rotating field produced by the current in the windings, it is practically independent of any stationary external field; the damping magnets can, therefore, be made of the strength required without affecting the accuracy. Magnetic damping is in general to be preferred to air dampers, as the resulting construction is more rugged and the clearances are greater. However, the torque of moving coil meters is so slight that air damping is sometimes preferred for them. Air damping would be entirely inadequate to properly control the high torque of induction meters.

The general make-up of the Westinghouse induction type meters is exceptionally rugged. The movement, due to its design, is inherently strong, since it consists of but a shaft, an aluminum cup, a damping disk, and the pointer. All these



Seven-Inch Induction Meter—All Parts Except Electro-magnets Removed

Seven-Inch Induction Ammeter—Scale and Scale Plate Removed

Seven-Inch Induction Ammeter—Scale Removed

Simple Moving Element of Induction Meter

parts are made sufficiently heavy to withstand abuse in service and handling.

The entire electro-magnetic element of the meter is mounted on a die-cast alloy frame, which also contains the rear sapphire jewel and provides a mounting for the front bridge to which are fastened the spiral hair spring which controls the movement, the zero-adjusting clip and screw, and the front sapphire jewel. Both the frame and the bridge are doweled so that in case the bridge should be lifted off to permit the removal of the moving element it can be replaced exactly in its former position, thus insuring the proper alignment of all parts. The frame also serves as a support for the dial plate and cardboard dial.

The damping magnets are mounted on a metal clip which is fastened by four screws to the die-cast frame. This method of mounting permits the ready removal of damping magnets with the certainty of having them exactly the proper position relative to the rest of the mechanism when replaced. The rigidity of the mounting prevents any displacement of the magnets and damage to the movement, or contact with the aluminum damping disk due to rough handling of the meters in shipment.

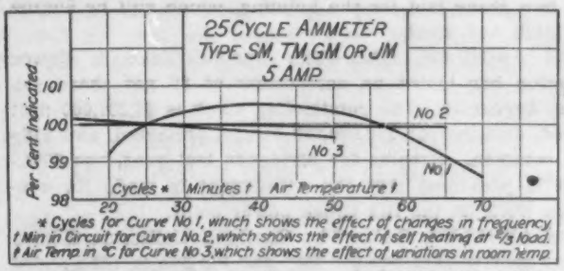
The jewels are of the highest grade sapphire, cut and polished in the same jewel department of the Westinghouse factory where the hundreds of thousands of sapphire jewels for watthour meters are prepared. The steel pivots, which fit into these jewels and carry the movement of the meter, are likewise ground and polished by experts and subjected to rigid examination and tests.

In the quality of the spiral spring used for the purpose of restraining or controlling the rotation of the movement, the performance of calibration largely depends. The spring is made of the finest phosphor bronze alloy, tempered, gold plated, and properly aged. The aging process is a source of treatment that aids the molecular rearrangement of the metal and allows the spring to take a permanent set which would otherwise be attained only after a prolonged period of natural aging. This artificial aging is followed by a period of natural aging, and the result is a spring that, when applied to the control of the moving element of a meter, insures absolute permanence of calibration.

The spiral controlling spring is held by a metal clip mounted on the bridge that holds the front jewel. This clip carries practically the entire weight of the spring, thus relieving the moving element of this weight. The clip also serves as a zero adjustment for the movement. The adjustment of the zero of the pointer is a very simple matter.

On removing the cover of a Westinghouse induction type meter, one is impressed by two things; first, the simplicity; and second, the high quality and beauty of workmanship and finish.

There is an entire absence of small screws, of delicate parts, in fact of anything that might be injured in ordinary handling. There are no moving wires or connections, no microscopic clearnes which might become clogged with a speck of dust or jammed, by the touch of a finger to a moving part. The possibility of inspection, adjustment, and repair by an ordinary man is apparent. An instrument specialist is not needed, nor is it necessary to "send the meter back to the factory."



Frequency, Temperature, and Self-Heating Characteristics of Westinghouse 25-Cycle Induction Ammeter.

Ordinarily the electrician or mechanic does not hesitate to repair any piece of electrical machinery in connection with a power plant, but, when it comes to a meter he throws up his hands with the idea that it is too delicate a piece of work for any one but a watchmaker or meter expert. The Westinghouse induction type of meter does away with this state of mind. The parts are accessible, they are few in number and the screws are ordinary machine screws, which can be handled without forceps.

It is the practice of some power companies to purchase all ammeters of five amperes capacity, and then apply them to one current transformer or another, as occasion demands, merely replacing the cardboard scale with one marked to the proper values for the indications of the pointer. The Westinghouse induction meter is admirably suited for this practice, owing to the ease with which the cardboard scale may be changed. It is not necessary to remove the meter from the board, nor to disturb the moving element or the mechanism of the meter in any way. The whole operation requires but a couple of minutes' time, and does not in any way disturb or effect the accuracy of the meter.

The weight of the moving element of the induction type Westinghouse meters is as light as is consistent with rugged construction. The torque is very high, in fact it has a value several times that found in any other type of alternating current meter. The result is a ratio of torque to weight that is exceptionally high—from four to six times that found in alternating current meters of other types. This is one of the most vital characteristics in the design of a meter, as a high ratio of torque to weight insures initial as well as long-continued accuracy.

The accompanying curves show the Westinghouse induction meters practically free from temperature and self-heating errors. They show that for any change in frequency that is likely to occur on a commercial circuit the accuracy of the meters is not affected. Add to all this the fact that the induction type meter is inherently free from influence by external fields, and it is self-evident that these meters can be depended on under all conditions of service.

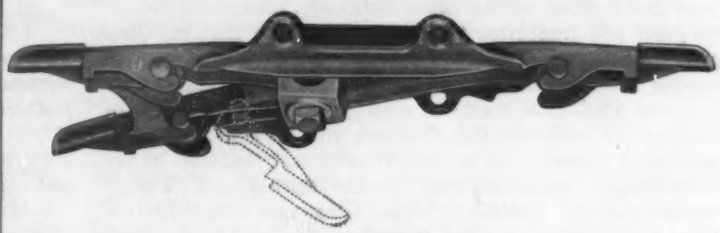
The Westinghouse induction meters are made in round cases 7⅜ inches and 9⅝ inches in diameter, also as large illuminated dial meters, and as vertical edgewise meters, 3, 4 and 5¼ inches wide.

NEW TROLLEY FROG.

The repair work on the overhead construction must be completed in a very short time to avoid tying up service when cars are running on short schedule and it is, therefore, important that a frog be simple in construction so as to minimize the operations necessary for installation, renewal of flexible tips and adusting of trolley wire.

The Frog shown in the illustration is a new design made by The Ohio Brass Company and consists of only six parts so that the time and labor necessary for its installation are coniderably less than for a more complicated design.

The important feature of the Frog is the combination renewable bronze tips and cam wedge. This piece is made to slip under hooks on the pan casting and has a cam action upon the trolley wire, forcing it down into the bottom of the groove in the pan and holding it securely whether the wire be new or badly worn.



Type D—Trolley Frog.

In installing, the wires are attached to the pan by the central clamp and a single machine bolt, after which the renewable tips are inserted under the hooks upside down with the ends pointing toward the center of the pan and are then forced over and outward until the lips enclose the wire ready to be peened around it—the final operation of the installation. In this position, the tips are interlocked with the end of the pan casting so that it is impossible for them to work out from under the hooks. When worn, the tips may be easily renewed without unfastening the wires from the pan casting.

The arms are provided with long gradual inclines which give an easy approach and the sides of the pan are flared outwardly at the ends to draw in any size wheel.

A deflector bar between the divering arms prevents the harp from being wedged should the wheel jump.

The Frog is made either all bronze with sherardized malleable iron pan and bronze tips, and is furnished for all sizes of wire.

NEWS NOTES

INCORPORATIONS.

SAN FRANCISCO, CAL.—Telephone Users' Association, $10,000, shares $1 each, subscribed $3, by A. G. Rockel, C. E. Ward and G. D. Stein.

WILCOX, ARIZ.—New State Telephone & Telegraph Company has been incorporated by D. A. Adams, T. J. Riggs and H. A. Morgan, with headquarters at Wilcox. They will extend the service into new fields.

ILLUMINATION.

NEWBERG, ORE.—A 25-year franchise has been granted to the Yamhill Electric Company for lighting the city.

OROFINO, IDAHO.—The Welch interests of Portland have purchased the Orofino electric light and power plant and other rights. Immediate steps will be taken to improve the property.

LAKEPORT, CAL.—The Mt. Konocti Light & Power Company of Lake County has applied for authority to extend its service from Lakeport to Kelseyville, Blue Lakes and Upper Lake.

VENTURA, CAL.—The Ventura County Power Company is putting in a new lighting system for the city, which will be completed about August 1. Wire-drawn filament lamps will be installed.

KENNEWICK, WASH.—The Pacific Power & Light Company has just closed enough contracts to justify extending the lighting system to the Kennewick highlands. The proposed extension will light 150 homes.

HOUSTON, TEX.—Building permits calling for building and improvements to cost $175,000 have been issued. One was for two large gas holders to be erected by the Houston Gas & Fuel Company, in line with their proposed improvements. The total cost of the tanks is to be $170,000.

LOS GATOS, CAL.—The Los Gatos Light & Power Company has applied to the State Railroad Commission to sell its plant and franchises to the Pacific Gas & Electric Company for $187,000. The latter company has been buying these smaller plants in contiguous territory for some time.

LOS ANGELES, CAL.—A meeting of the stockholders of the Central California Gas Company will be held September 25th at 10 o'clock a. m. at the office of said company in the International Bank Building, corner Spring and Temple streets, for the purpose of considering and acting on the matter of creating a bonded indebtedness of said company in the sum of $500,000 to be evidenced by 1000 bonds of the denomination of $500 each.

FRESNO, CAL.—That the contract executed between the San Joaquin Light and Power Company, is only for temporary service, until the latter company can complete its new power house on the Tule River near Tulare, was the substance of a statement made by W. A. Sutherland, speaking as attorney for the San Joaquin Company. The contract calls for 1000 h.p. to be sold to the Tulare County Power Company. According to Sutherland, the Tulare Company is composed largely of former patrons of the Mt. Whitney Company. The recent decision of the Railroad Commission, allowing the San Joaquin Light & Power Company to extend its line into Tulare county, will now permit the company to rush work on its 50,000-volt line through the county. It is expected that this work will soon start.

SACRAMENTO, CAL.—A readjustment of rates in portions of Shasta and Tehama counties, in response to the application of the Northern California Power Company has been made by the Commission, following the rate war there with the Sacramento Valley Power Company. The Northern Company recently absorbed the other and asked to be allowed to raise rates to the old basis. It was found by the Commission that the rate war had forced returns below a profitable plane and it was allowed a maximum lighting rate at 9c a kilowatt instead of the 10c asked by the company. The Commission found that the company had declared a valuation of $20,000,000 upon its property. It developed that $11,000,000 had gone into the property and that the company claimed the balance for water rights. The Commission takes the stand that the par value of the stocks and bonds does not furnish a standard for rate-fixing purposes. It discusses the suggestion that hydroelectric power companies be allowed to capitalize their water rights. No ruling is made, but the Commission refers to the proposal for such capitalization as a desire to capitalize the "generosity of the public."

TRANSMISSION.

BAKER, ORE.—The Idaho-Oregon Power Company, with offices in Boise, announces that it will enter this field with its power lines.

ROSEVILLE, CAL.—The Commission has granted the application of the Great Western Power Company to extend its lines to Roseville, Placer County.

SPOKANE, WASH.—Harvey N. Ross, secretary and manager of the Nabob Mining Company, and C. F. O. Merrian, the chief engineer, have closed a contract with the Washington Water & Power Company for the construction of a high potential line from Wardner to the Nabob mine and for furnishing power to operate the compressor plant.

BELLINGHAM, WASH.—To handle the electric power that will be brought to the city from the Stave Lake Power plant for the use of the Whatcom County Railway & Light Company, a high-power switching station will be constructed at once near the site of the present power plant. The foundation is now being laid for the building, which will be 50x100 ft., of brick and steel.

LOS ANGELES, CAL.—The Pacific Light & Power Corporation has levied an assessment of $5 per share, delinquent August 30. The outstanding stock is $1,207,000 first preferred, cumulative; $10,000,000 second preferred, and $12,207,000 common. Surplus for dividends last year was $594,000. It is presumed that the assessment is made for construction work on the Big Creek power plant.

LOS ANGELES, CAL.—The Southern California Edison Company reports earnings for May and for five months ended May 31:

	1912.	Increase.
May Gross earnings	$348,688	$60,257
May net	166,216	25,465
Surplus	107,614	21,869
Five monhts gross	1,741,441	272,903
Five months net	843,019	107,446
Surplus	542,390	83,625

PHOENIX, ARIZ.—The Miami Copper Company and the Inspiration Consolidated Copper Company want to enter into a ten-year contract to purchase all the surplus electric power generated under the Salt River project. They agree to build an auxiliary steam plant, also to build a transmission line from Roosevelt to Miami. In about six months the 1000 h.p. plant at Arizona Falls will be finished. Another plant is to be built on the New Crosscut canal that will generate 600 h.p. About 30,000 h.p. will ultimately be developed under the Salt River project.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company reports for the five months ended May 31st as follows: Gross earnings, $6,277,512; expenses, including taxes and reserves, $3,428,815; net earnings, $2,848,697; bond and other interest, $1,420,643; net income, $1,428,054; bond dis-

count and expense, $41,552; preferred stock dividends, $300,000; common stock dividends, $365,169; surplus for depreciation and other purposes, $721,333. During the five-months' period covered by the above statement the company gained 8300 new consumers. Gas sales, as compared with the same period of 1911, increased more than 245,000,000 cubic feet, and at the present rate will exceed those for 1911 by 600,000,000 cubic feet. The electrical business of the company also is growing at a most satisfactory rate. Contracts for more than 10,000 horsepower were signed up in the six weeks since May 31st, or at a rate of 1600 horsepower a week. This growth was well distributed over the entire system, the average of these contracts being about forty-five horspower each.

PORTLAND, ORE.—The Portland Railway, Light & Power Company for the month of May shows earnings of 6.22 per cent and for the five months ended May 31 of 5.5 per cent, on its $25,000,000 stock. While gross earnings for the month gained 3 per cent and for the five months 4.3 per cent, the surplus for the stock for the month showed a decrease of 19.9 per cent, and for the five months a decrease of 18.1 per cent from the corresponding periods of 1911. The decrease in surplus earnings was due to the increased operating expenses and the larger interest charges. For the month the cost of operating increased 8.6 per cent, and for the five months increased 10.3 per cent. This was largely caused by an increase in the taxes levied on the property by the city and county. Interest charges for May increased 22.2 per cent and for the five months increased 17.8 per cent. This increase in fixed charges came because of the issue of additional bonds and the sale of $5,000,000 notes to pay for the Mt. Hood Railway Company. The earnings of the Mt. Hood Company have not yet begun to show to any appreciable extent in the gross of the company, but with the completion of work now under way they are expected to add materially to the earnings of the company. The last seven months of the year have always been the best for the company, and by the close of 1912 it is believed that the present decrease in surplus earnings will be wiped out and as large earnings shown for the stock as in 1911, when 7 per cent was earned on it. Dividends at the rate of 1 per cent quarterly are being paid on the $25,000,000 of stocks.

TELEPHONE AND TELEGRAPH.

KLAMATH FALLS, ORE.—The Pacific Telephone & Telegraph Company will begin at once on the new common battery telephone system in this city.

CUCAMONGA, CAL.—The Ontario & Uplands Telephone Company is reported to have decided to establish an exchange in Cucumonga, so that all local business will be handled there.

CONCRETE, WASH.—Mrs. K. Glover, manager of the Skagit River Telephone Company, is looking over the country with a view of extending the lines from Rockport to Marblemount.

BOISE, IDAHO.—The City Council will advertise for bids for installing an underground cable system. The Board of fire underwriters insists that fire alarm wires be placed in cables not used by the telephone company.

FULLERTON, CAL.—Bids will be received up to September 2 for a franchise granting the right to construct poles, wires and other appliances and conduits for transmission of electricity for telephone and telegraph purposes.

PASADENA, CAL.—With the issuance of a permit to the Home Telephone Company to make alterations in its building at 68 N. Raymond avenue, actual work has been begun on the consolidation of two companies now operating in this city.

LINDSAY, CAL.—The Railroad Commission has denied the application of the Lindsay Home Telephone & Telegraph Company to raise its suburban rate from $1.50 a month to $2.50 a month. The Commission granted a special rate of $1.75 for desk telephones.

TRANSPORTATION.

RIVERSIDE, CAL.—A contract was closed this week by the Pacific Electric Railway with the Riverside-Portland Cement Company for the delivery of 15,000 tons of crushed rock to be used in rebuilding the Magnolia and Colton avenue electric line.

EL SEGUNDO, CAL.—The citizens of El Segundo are expecting to have the Pacific Electric Company run their cars into town within the next 30 days. A complete right of way has been secured, and only about two miles of track will have to be laid to connect the road already built out of El Segundo with Hawthorne.

LOS ANGELES, CAL.—City Engineer Hamlin's estimate of the cost of the proposed municipal railroad to the harbor is $2,268,551 with a probable additional cost of $2,000,000 for right of way and damage to property. The estimate includes plans for 4.72 miles of double track and pavement on streets, and 15.56 miles of double track on private rights of way.

SAN FRANCISCO, CAL.—The State Railroad Commission has rendered a decision granting the Northern Electric Railway Company, permission to issue $600,000 of 5 per cent bonds. The original application was for $1,100,000. The applicant later asked that $600,000 in bonds be allowed at this time and the remainder be considered at a later date. The Commission granted this request. The proceeds of the present issue will go toward the construction of the Marysville and Colusa branch of the Northern Electric and for a branch across the Sacramento at Meridian.

SAN FRANCISCO, CAL.—An application has been filed with the Railroad Commission by the Anglo-California Trust Company and the United Railroads for the authorization of the purchase of 65 street cars at a price not to exceed $365,000, or a little less than $6000 a car. The trust company will act as the trustee. The cars will be purchased direct from the manufacturer and held by the Trust Company. They will be paid for as they are needed by the United Railroads. In the application it is stated that the parties to the application do not believe the deal comes under the powers of the Railroad Commission, but they have made the application to settle any doubt.

SAN FRANCISCO, CAL.—John Rosene, the Seattle capitalist who is at the Palace, says: "I am seeking a concession for the mono rail means of transportation from the Exposition people here. I want to build it through the Exposition grounds by way of the Presidio to Golden Gate Park. In connection with Judge R. Fitzpatrick of Redwood City, I may also build one of these roads between Redwood City and Woodside in San Mateo county. Regarding the standard railroad for Alaska in which I am interested with a Canadian syndicate, I can say that it is about 800 miles long, starting from Haines, on the Lynn Canal, and ending at Rampart on the Yukon. It is to run through the Fairbanks country. The new road will have a mileage of about 540 in Alaska and some 275 on Canadian territory."

SAN FRANCISCO, CAL.—Plans prepared by the quartermaster's department to extend the Presidio electric line through the Presidio to Fort Winfield Scott are being considered by the War Department. The extension to the present line will take a circuitous route to Fort Winfield Scott, necessitating about three miles of track. It will start at the terminal of the Union street line, in front of the Letterman General Hospital, in the Presidio, and proceed along the south drive and around the back of the bachelor quarters. From this point it will continue to the base of Infantry terrace, thence swinging over the flat to the upper end of the infantry quarters, to the rear of the national cemetery into Fort Winfield Scott reservation, up the hill and past the barracks to the old brick fort at the Golden Gate.

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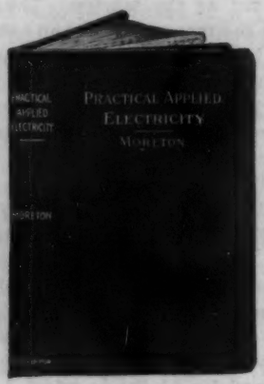

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